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VOLUME 1 NUMBER 4

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APRIL 1, 1919

PUBLISHED MONTHLY BY AMERICAN MEDICAL ASSOCIATION, 535 NORTH DEARBORN STREET, CHICAGO, ILLINOIS. ANNUAL SUBSCRIPTION, $5.00

Entered as second-class matter January 7, 1908, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized Jan. 15, 1919.

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Archives of Neurology and Psychiatry

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DISTURBANCES OF SPATIAL ORIENTATION AND VISUAL ATTENTION, WITH LOSS OF STEREOSCOPIC VISION *

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AND
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Captain, M. C., U. S. Army

The following case is placed on record as it is an excellent example of a type of special disturbances of vision which claim our interest, not only on account of their relative rarity, but chiefly because they throw considerable light on the functions and modes of activity of the cerebral cortex, and particularly on those processes which are concerned in the integration and association of sensations.

The case is described at length as the patient exhibited many symptoms which could be fully understood only when carefully studied and analyzed. We were particularly fortunate in that he was an intelligent, willing and objective witness, and had no disturbances of speech, or motor or sensory symptoms that could complicate our observations. On the other hand, we have made our discussion of his condition as concise as possible with due regard to clearness, more especially as one of us has recently recorded six other cases with more or less similar symptoms, apart from the loss of stereoscopic vision, and there dealt more fully with their nature and significance.

REPORT OF CASE

History.—The patient, Private W. F., aged 30, had been a circular saw operator and was an intelligent and fairly well educated artisan. He was wounded May 19, 1918, probably by a machine gun bullet, but as he became at once unconscious and remained so for several days, it was impossible to obtain an accurate history. He was admitted on the same day to a casualty clearing station with a perforating wound of the head; both entrance and exit wounds were excised, fractured bone removed, softened and extruding brain-matter evacuated, and the scalp excisions were then sutured. The patient, however, remained still unconscious, vomited repeatedly and had several epileptiform fits which affected chiefly his left side. On the sixth day he asked for food, and it was recorded in his notes that he could then see.

* Passed for publication by the War Office, British Army Medical Service.

Examination.—When he came under our observation in a base hospital on June 2, the wounds were healed. The entrance, on the right side, was represented by a horizontal incision 6 cm. in length, under which a trephine opening 4 by 5 cm. in diameter could be felt; its center was 6 cm. above the inion and 5½ cm. to the right of the middle line of the skull. The exit wound was also represented by a horizontal incision over a trephine opening 2 by 4 cm. in diameter, with its center 10 cm. above the inion and 5½ cm. to the left of the mesial line (Fig. 1). A roentgenogram revealed only these operative defects in the skull and a linear fracture connecting them.

When he arrived at the base his general condition was satisfactory, and he was alert and intelligent. There was no trace of weakness, incoordination or disturbance of muscle tone; he could move his limbs easily and

Fig. 1.—Posterior view of the patient's head on which is indicated the position of the wounds of entrance and exit. The central white line indicates the mesial sagittal plane.

employ them naturally in all actions. No affection of sensation could be detected, and his reflexes were also normal. The movements of his face, tongue, palate and jaw were undisturbed. There was no squint and he did not complain of diplopia. His pupils were large, but reacted perfectly to light, and hearing was also normal in both ears. Speech was unaffected; he expressed himself readily and correctly, understood fully all that was said to him, and named promptly all objects he recognized. He could write correctly though owing to his visual disturbances he frequently placed the words he wrote irregularly on the paper. His difficulty in reading, which did not depend on an aphasia, will be dealt with later.

During the three months he remained under our observation he appeared an intelligent and cheerful man; his attention, apprehension and memory were intact, and he was never unnaturally emotional. He also proved in all our investigations to be an extremely good and objective witness, who did not attempt to interpret his sensations, but merely described what he perceived.

Vision.—The acuity of his central vision was never seriously affected. Fourteen days after he received his wound he could count fingers and recognize objects, and when tested a few days later he read words in ⅛ inch print; five weeks after the infliction of the wound his vision was 6/12 in each eye, and when his error of refraction — slight myopic astigmatism — was corrected it rose to 6/9 and Jaeger 1. His optic disks and fundi were normal. He had never noticed any visual aurae or spectra, as flashes of light or color. The visual fields were at first much contracted; Major G. Derby, who kindly tested him with a perimeter, found that he could recognize a white object 1 cm. square only in the right upper quadrants and within 30 degrees of the fixation point. On July 15 vision to small objects extended to the normal limits in both upper quadrants, but the lower remained permanently blind; the blindness reached to 2 degrees from the fixation points and corresponded approximately to the horizontal radii through them, except to the right where vision had recovered a slight distance below them (Fig. 2). This inferior horizontal hemianopia remained unaltered till he was transferred to England more than three months after the infliction of the wound. Though he was repeatedly tested, no scotoma or amblyopia could be found in the upper seeing quadrants. There was no agnosia, in the sense that he was unable to recognize the use and nature of objects which he could perceive by either central or extra-central vision.

Important Symptoms.—The special symptoms which give interest to this case were investigated repeatedly between 36 and 100 days after the infliction of the wound. They varied very little during this time, but they will be described here chiefly as they were observed in the later portion of this period.

There was no evidence of any ocular palsy; he moved his eyes to order readily and accurately in every direction, but from the day he first came under observation he had much difficulty in fixing objects which he could see. If spoken to suddenly he first stared in a wrong direction and then moved his eyes about until they fell, as if by chance, on the observer's face; he was extremely slow and inaccurate in his attempts to fix or bring into central vision any object when its image fell in the periphery of his retinae, especially if it were small. When, however, requested to look at his own finger or to any point of his body which was touched he did so promptly and accurately, moving as a rule both his head and eyes in the normal manner. Except in the early stages of his illness he had no difficulty in maintaining fixation on an object that was in central vision; each time, for instance, his visual fields were examined he succeeded in keeping his eyes on the fixation point of the perimeter, but if they deviated from it for even a moment he was slow and awkward in finding it again. When an object at which he was staring was moved at a slow and uniform rate he could keep his eyes on it, but if it was jerked or moved abruptly it quickly disappeared from his central vision.

This difficulty in obtaining fixation and in bringing objects seen into central vision diminished considerably, but did not disappear completely while he remained under our observation. He generally turned his eyes promptly and accurately toward any unexpected sound, but not to light; when at night

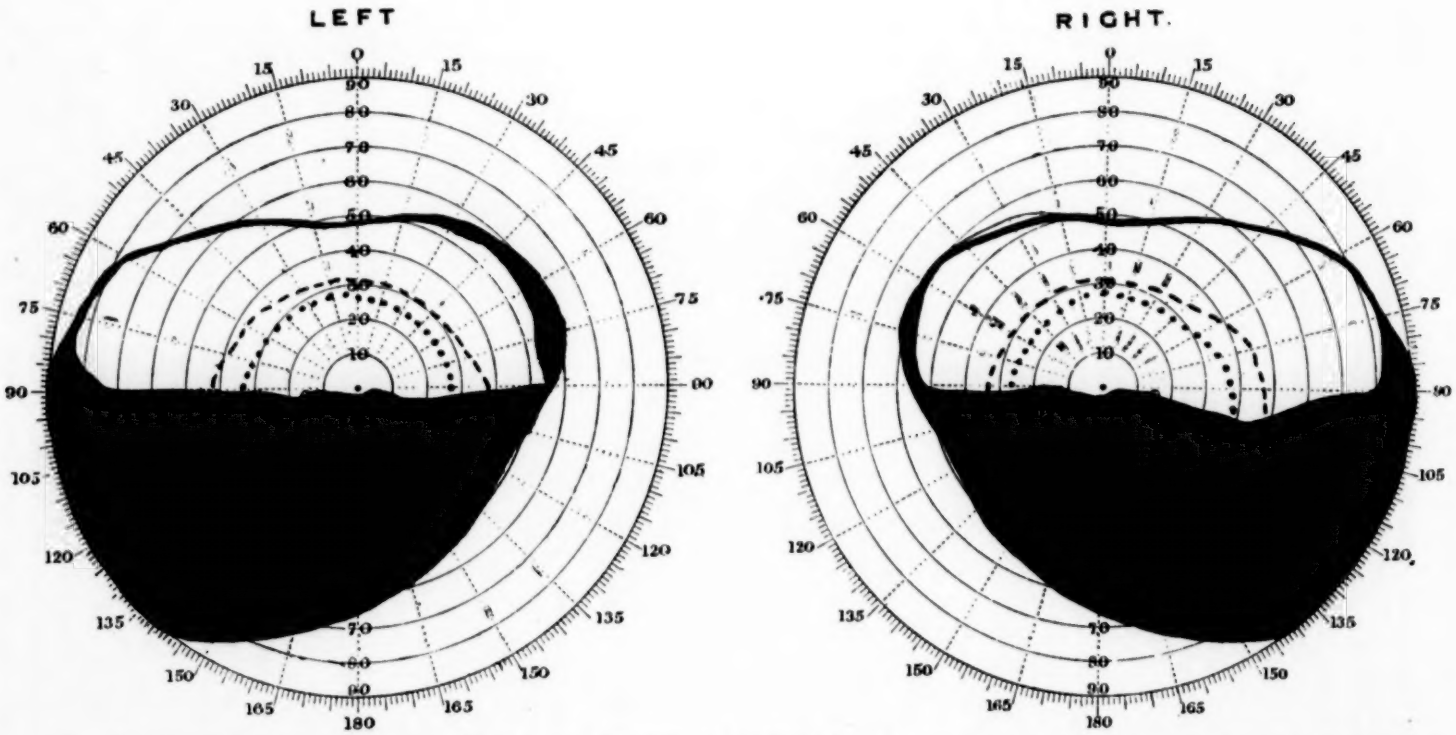

Fig. 2.—Visual fields recorded with 10 mm. square white and colored objects on Aug. 3, 1918. The broken line indicates the limit of red vision; the dotted line the field for green.

an electric torch was suddenly flashed at various points around his bed he turned his eyes slowly, and less accurately than a normal person, in the direction of each flash.

Accommodation for near objects was even more severely affected; when a pencil was moved slowly toward his eyes these failed to converge, and his pupils did not contract; when it had come within 8 or 10 inches (20-25 cm.) he could no longer see it distinctly and was conscious only of the presence of a moving object, the shape or form of which he was unable to recognize. If, however, his own finger were moved passively toward his face, or if he brought an object held in his own hand toward it, his eyes converged normally on it, his pupils contracted briskly and he accommodated so that he could see it distinctly when it was only 4½ inches (12 cm.) distant from his eyes. He also converged accurately and his pupils contracted promptly when he was asked to look at the tip of his own nose.

Another noteworthy symptom was the complete absence of the blinking reflex; if the observer's hand or any large object, as a book, was unexpectedly swung toward his eyes he never blinked, withdrew his head, or reacted as the normal person does, unless the movement produced a current of air sufficient to attract his attention. On one occasion he explained, "Your hand seemed to come nearer to me, but I had no idea how near it came, I thought it was plenty far off." But on another day he said, "I did not see that it was coming toward my face." If, however, his own hand was suddenly jerked by the observer toward his eyes he always reacted normally to the threat.

His visual memory, for both form and color, of impressions obtained in earlier years was apparently intact; he was evidently a strong visualist and described as a visualist does his house, his family, a hospital ward in which he had previously been, etc. But, on the other hand, he had complete loss of memory of topography; he was totally unable to describe the route between the house in a provincial town in which he had lived all his life and the railway station a short distance away, explaining "I used to be able to see the way but I can't see it now." From his statements it was evident that he had formerly a clear visual picture of it which he could no longer evoke. He was similarly unable to say how he could find his room in a barracks in which he had been stationed for some months, or describe the geography of trenches in which he had served. His visual retentiveness was also defective; when he was, for instance, shown in rapid succession four objects, as a key, pencil, scissors and knife, he could never name them all or remember the correct sequence after an interval of 20 seconds, though after an even longer interval he could always repeat accurately four or more words which were uttered to him.

Visual Inattention.—There was one disturbance of vision which had so much influence on his other symptoms that it must be more fully described. As mentioned already he had, as far as could be judged, normal or practically normal vision to the natural limits of the upper quadrants of his visual fields; these were repeatedly explored and even when small white objects, 2 mm. in diameter, were used no defects could be discovered, and the color fields within them were also normal. When the observer's two hands were held up, one on either side of his visual axes and at equal angles from them, he could always perceive the slightest movement of either when it alone was moved, but he failed constantly to recognize the simultaneous movement of both hands and saw indiscriminately that to his right or left only.

It mattered not whether the observer's two hands were near his visual axes or far lateral to them, he failed to perceive the simultaneous movement of both though he always recognized the slightest movement of one or the other. Even when he held up his own hands in the seeing portion of his visual fields he stated that while his eyes were fixed on some other object he could see only one at a time, either that to his right or to his left, according as his attention was attracted by it.

In one test, while he fixed his eyes on a needle which was stuck in a table, two pencils, a red and a yellow one, were placed 5 cm. on each side of it, at a distance of 50 cm. from him; then while gazing at the needle he could see one pencil only, and indiscriminately that to his right or left. Similarly when a box was placed in front of him so that two of its sides made equal angles with his visual axes he could, while he looked at its edge, see one side only but not both simultaneously; he explained, "I can see one side, but my eyes can't get past the corner." Even if his two index fingers were placed on the two visible surfaces he could see one only if he fixed the edge of the box; and when one side was colored blue and the other remained white he saw only one, but in addition a blue or a white "streak" which he did not associate with the idea of a box.

This inability to perceive and recognize movement and objects under certain conditions cannot be attributed to blindness or hypo-esthesia of parts of the seeing quadrants, for in the first place no such disturbances could be detected though searched for several times; and secondly, he constantly failed to perceive the images of objects that fell on portions of his retinae which immediately before or afterward were obviously sensitive to the same impressions. The essential feature was his inability to direct his attention to, and take cognizance of, two or more objects that threw their images on the seeing portion of his retinae. As this occurred no matter on what parts of his retinae the images fell, it must be attributed to a special disturbance or limitation of attention, but visual attention only was so affected as he did not behave similarly to tactile or other impressions.

It might be expected that as a result of this affection of visual attention he would be unable to see the whole of large objects presented to him at a near distance; but, provided part of the image did not fall on the blind portions of his fields, this was never obvious in examination. He recognized objects and even complicated geometrical figures as promptly as normal persons, and apparently without exploring them fully by movement of his eyes. He explained this by saying, "I seem to see the whole figure in the first glance," though he occasionally failed to do so if some peculiarity or prominent portion of it at once claimed his attention. In one test, for instance, a large square was drawn on a sheet of paper and he recognized it immediately, but when it was again shown to him after a cross had been drawn in its center he saw the cross, but identified the surrounding figure only after considerable hesitation; his attention seemed to be absorbed by the first object on which his eyes fell. He could recognize as promptly and as accurately as several normal persons who were tested as controls, the shape and nature of small objects placed in various portions of the seeing fields, when they were exposed singly to him by allowing screens in front of them to drop.

Spatial Orientation.—The most prominent symptom, however, from the time he came under our observation till he left the hospital three months later, was his inability to orientate and localize correctly in space objects

which he saw. When within the first few weeks he was asked to take hold of or point to, any object, he projected his hand out vaguely, generally in a wrong direction, and had obviously no accurate idea of its distance from him. His failure to touch or point to objects seen could not be attributed to ataxia, or to any motor or sensory disturbance, as both the movement of his limbs and their sensibility were intact, and he employed them naturally and expertly in all action that did not require visual control. Other observations which will be recorded will leave no doubt that these symptoms were due to his visual disturbances only.

It was only during the first few weeks that he made gross errors in pointing to a test object that was in central vision, but even thirteen weeks after the infliction of his wound he frequently failed to bring his finger accurately to or pick up small objects, though he had learned by experience their distance from him. His errors were indiscriminately to either side of, or above or below his aim, and not predominantly in any one direction. If the object was not in central vision his errors were much greater; when, for instance, he attempted to touch the observer's finger while his eyes were fixed on his face he generally brought his hand several inches to one or other side of it. This inability to localize in space objects outside central vision was repeatedly investigated by the aid of a perimeter. A piece of white paper 10 mm. square was suddenly presented to him on the arc of the perimeter while his eyes were directed on its fixation point, and he pointed to it immediately on recognizing it.

In Figure 3 the Arabic numerals indicate the actual positions of the test object and the corresponding Roman figures the positions in which he judged it to be. As a rule he estimated the object seen to be nearer his visual axes than it actually was, but this was not constant. As he was aware of the distance of the arc from his eyes and knew that this did not vary, erroneous estimation of the distance of the object cannot account for these mistakes, and it is improbable that they were due to any disturbance of retinal sensibility for none could be detected. Further, when the same test was applied to two men who, as a result of occipital wounds, had large scotomas with surrounding zones of amblyopia in which white appeared indistinct and colors could not be recognized, it was found that both could localize the object correctly when they could see it, even if it lay in the amblyopic area of their visual field. An acromegalic with a large area of temporal amblyopia in one eye also orientated objects perceived in this amblyopic region much more accurately than our patient.

This defect could be observed in all actions of his ordinary life in which he relied on visual guidance; he had to grope for his food and any thing he wished to pick up, but his trouble ceased the moment he touched it.

His errors in the estimation of the distances of objects seen were even greater and more obvious, whether they were in or outside central vision. If the object he wished to touch was within easy reach he almost invariably projected his hand beyond it, and there was consequently an apparent tendency to overestimate distances; but when it was beyond his arm's length he often attempted to grasp it before his hand had reached it. He was consequently liable to overestimate or underestimate distances. In these tests he frequently complained that he had "no idea how far it was from him."

He had never any difficulty in *localizing by touch;* when any point on his own body was touched while his eyes were covered he brought his finger to it with normal promptness and accuracy. The contrast between the

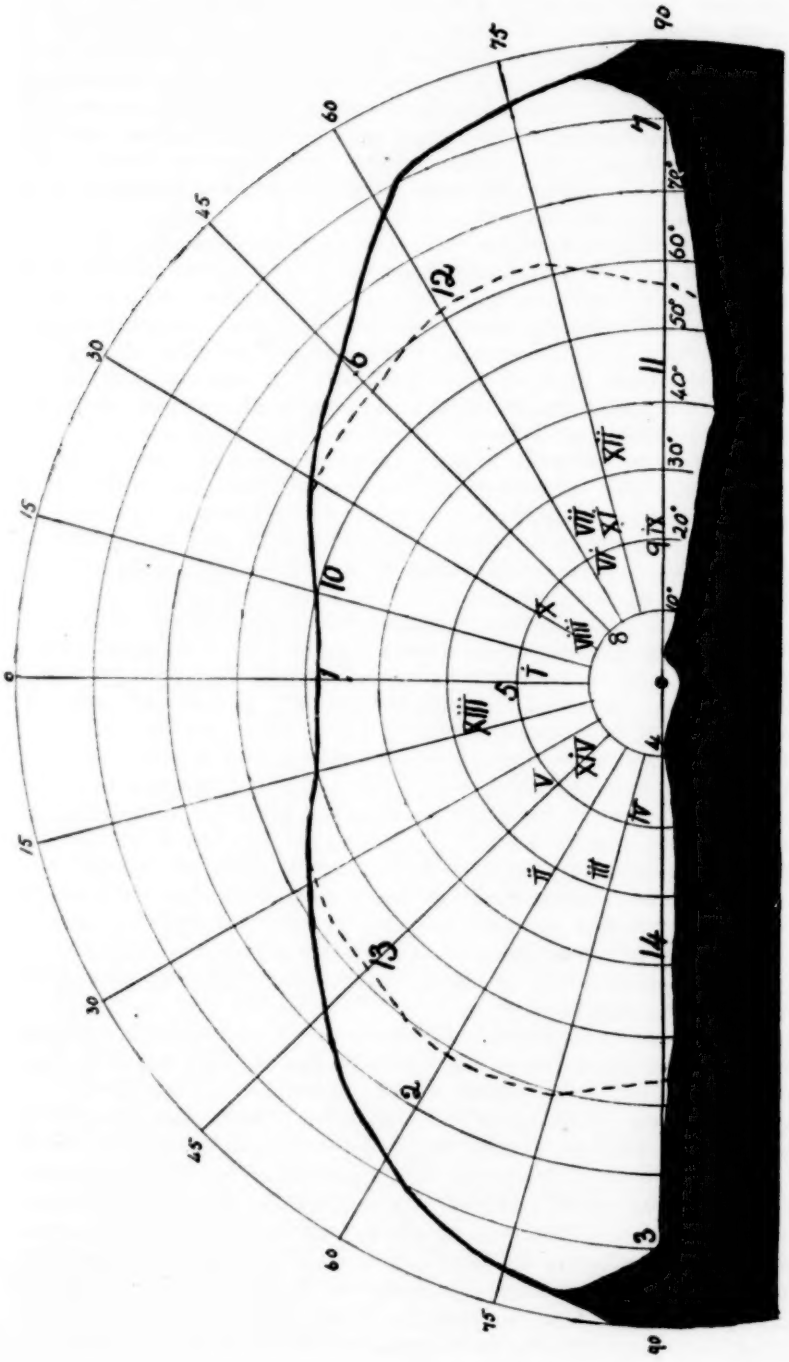

Fig. 3.—The binocular visual field to represent the false localization of objects seen by extramacular vision. The Arabic numerals indicate the true positions of the objects; the Roman figures the positions into which the patient projected them.

defective spatial guidance he received from vision and the accurate knowledge of space that contact gave him, was excellently illustrated when he attempted to take soup from a small bowl with a spoon; if he held the bowl in his own hand he always succeeded in placing the spoon accurately in it and in obtaining a spoonful of food, but when it was held by an observer or placed on a table in front of him he could rarely bring his spoon to it at once, but had to grope for it till he had located it by touch.

His defects in spatial localization by vision were equally obvious when he attempted to estimate the relative positions of two objects. When a silver and a copper coin were placed on a table he usually said both appeared the same distance from him, or if urged to decide, often described the one which was further away as the nearer one, and vice versa. Similarly, when a man in blue hospital uniform stood 7 yards and one in khaki 14 yards away, he described both as at the same distance; when the man in blue approached to 5 yards, he recognized that he was the nearer, but when later he moved 3 yards further away he was certain that they were at the same distance from him. "Everything seems practically the same distance from me," he remarked on one occasion. A yellow pencil was held up 30 cm. and a blue one 60 cm. from his eyes; he could form no idea of their relative positions, but he recognized it at once when he was allowed to touch them in succession with his hand. When the pencils were at such a distance apart that they made a wide angle with his eyes he explained, "They seem the same distance from me because I can see only one plainly at a time; I have to shift my eyes from one to get to the other," but this was certainly not the correct interpretation as he still failed to recognize their relative positions when one was almost behind the other, so that both were practically in central vision. If a screen was placed between his hand and any object he wished to reach, he invariably brought his hand against the screen even though he had seen it; he then became confused and evidently could not appreciate the spatial relations of the two objects.

His judgment of the distance from him of objects seen was repeatedly tested; it was as defective three and a half months after the infliction of the wound as during the first two weeks. On one occasion he estimated that a man 20 yards from him was 100 yards, while a chimney at least 150 yards distant he thought was only 50 yards away. A pencil was held up at various distances from him; when it was 24 inches he estimated it at 12 inches, when 5 feet he said 18 inches, and later did not recognize it had been moved when it had been brought to 8 inches from his face while his eyes were momentarily closed; when at 2 feet he said it was about 7 feet away. He underestimated or overestimated distances indiscriminately.

When, however, he was asked to place his hand at a certain specified distance from his face, or to indicate by his two hands the extension of ordinary standards of linear measurement, as an inch, a foot, or a yard, his replies were approximately correct. He could also indicate the lengths of familiar objects, as his rifle, bayonet, etc.

Appreciation of Length and Size.—If two lines of different length were drawn obliquely to one another so that their retinal images were not easily superimposed he could rarely distinguish their relative lengths even when the difference was considerable. Lines 5 cm. and 8 cm. long appeared to him equal, nor could he recognize that one was shorter than the other though they were 10 cm. and 15 cm., respectively. If, however, the lines were

parallel and close together he could generally distinguish, though not as readily as a normal person, their relative lengths. He also made gross errors in comparing the lengths of such objects, as two pencils, which were shown to him, though his replies were invariably correct when he touched them. In the early stages of his illness he was unable to recognize any difference in the sizes of such objects as a franc and a 50-centime piece, but three months later he could distinguish sizes more certainly, though not within the normal limits of discrimination. His attempts at dividing a line, or at finding the center of a circle, were generally very inaccurate, but he always seemed satisfied with his results.

Though he failed to distinguish any difference in the lengths of lines, even if it was as great as 50 per cent., he could always recognize whether a quadrilateral rectangular figure was a square or not. In one test when an oblong of which the pairs of opposite sides were 4.2 cm. and 4.5 cm., and a square of the same area were drawn on separate pieces of paper, his judgments as to whether both were true squares, and if not whether the one figure was the higher or broader, were invariably correct. He explained that in order to decide whether a figure was or was not a square he did not compare the lengths of its sides but "on the first glance I see the whole figure and know whether it is a square or not." When he decided that a figure was a square we could never convince him that it was not, or vice versa. Similarly he never confused a slightly elliptical figure with a circle. He could also appreciate to some extent the sizes of angles; a rhomboid even when its sides stood at almost right angles was always "a square shoved out of shape."

It is therefore obvious that though he could not compare or estimate linear extensions he preserved the faculty of appreciating the shape of bidimensional figures. It was on this that his ability to identify familiar objects depended.

Recognition of Movement.—When an object in central vision was moved at a slow and uniform rate he was often uncertain whether it approached toward or receded from him, but he always appreciated the movement and recognized its direction when it made an angle with his visual axes. This was demonstrated by a piece of simple mechanism; one end of a rod 50 cm. long was fixed to an axis that could be rotated by clockwork at an extremely slow and uniform rate, while its other end carried a small luminous point. The patient was placed in an absolutely dark room, so that he had no background against which to compare the movement, with his eyes at the point of rotation, and his gaze directed on the luminous point. He made a signal when he perceived the slightest movement and then described its direction. His replies were as prompt and as accurate as those of controls tested similarly. The smallest movement could be recognized also by peripheral vision, but unless its range was much greater than a normal person requires he made many errors in describing its direction. When, for instance, a piece of paper fixed on the end of a holder was brought from behind him into the periphery of his visual fields he was often unable to recognize whether it was moved up or down, backward or forward, or laterally unless its range was large. Even when the object was near his visual axes but outside macular vision, he was often uncertain of, or mistook, the direction of its movement if this were small.

The patient began to walk sixty days after he received his wound, and then many other interesting symptoms could be observed. From the first there was no obvious abnormality in his gait, but he progressed with

short, slow steps and his hands held out in front of him, like a man groping his way in the dark. When asked to go across the ward he invariably walked into any obstacle in his way, even though it was large and prominent and he had observed it before he started; he walked with considerable force into a wall, collided with a large red screen that stood in his path, and when asked to come to the observer he continued on his course till he had bumped heavily into him. When told to sit down on a chair some yards away he proceeded till he had knocked it over with his knees, but immediately on touching it he righted it and placed himself correctly in it. On colliding with such obstacles he showed great surprise and considerable discomfiture, and generally explained that he had not realized he was so near to them. The fact that he frequently stopped and searched with his hands toward objects still some yards from him is clear evidence that he also underestimated distances. Further, when he had run into a large obstacle, as a table or screen, he had considerable difficulty in getting around it; he could not understand how to circumvent it immediately unless he placed his hands on it and felt his way out of his difficulty.

These symptoms remained practically unchanged during the time he was under observation. Even if before starting he was made to describe and point out the obstacles in his path he still ran into them, though by experience he learned to grope continuously with his hands in front of him if he saw or suspected the presence of anything against which he might hurt himself.

He frequently failed, too, especially during the first weeks after he left bed, to walk in the correct direction toward any point he wished to reach. On one occasion, for instance, he was led a few yards from his bed and then told to return to it; after searching with his eyes for a few moments he identified the bed, but immediately started off in a wrong direction. Later he occasionally failed to take the straight course to a chair on which he wished to seat himself. Three months or so after the infliction of the wound this rarely occurred, provided he kept his eyes fixed on his aim, but immediately his eyes deviated from it he generally turned into a wrong direction and wandered aimlessly about till it had again come into central vision.

Some of the most interesting observations were made on a large flat roof that was divided by a wooden paling, about 4 feet high, with an open gate in it through which it was possible to pass from one into the other portion; there was a step about 1 foot high at this gate. Day after day he was brought to this roof and told to walk from one spot in its larger division, which will be referred to as A, to a point at the balustrade around the smaller portion, which we will call B. He always remembered that he had to pass through the gate and that there was a step there, but even after he had been repeatedly over this route he frequently set out in a wrong direction unless his eyes had been fixed on the gate; his course was often at right angles to the correct one, but as a rule he walked into the paling some distance from the gate and then guided himself to it by a hand which he kept on the paling, rather than by vision. When he had succeeded in passing through the gate he often took a wrong direction toward B, and reached it only by groping with his hands along the balustrade. When asked to return to the observer at A, he almost invariably ran into the paling again. He was never able to give even an approximately correct description of the way he had taken, or should take, to go from A to B, and though he passed along it several times day after day he never "learned his way" as a blind man would. When,

in fact, he was blindfolded he succeeded in finding his way about as well as when he had the aid of vision, and to one of us he seemed to walk with more confidence.

If after he had walked some distance he was questioned as to what he had passed he could recount the more prominent objects he had noticed, but could never give an accurate description of their spatial relations to one another. On one occasion he was taken to the edge of the roof and from there saw and recognized several objects, as two men in a boat about 500 yards away, the distinguishing features of an aeroplane at the same distance, and several ships. When his eyes were then covered he described these separate objects, but was quite unable to point to the direction in which he had seen them, or to say what their relations in space were to one another.

This and many other tests showed that he possessed good visual acuity, for he could see and recognize distant objects almost as well as persons with normal vision, but the associated sense impressions gave him no idea of the spatial relations of the individual objects, or of the topography of an area or surface that he had viewed; he could never evoke a memorial image of them.

Localization of Sound.—His power of localizing by sound was tested on several occasions. While he was still in bed he was asked to point in the direction of a sound made by striking two pieces of metal together, and this he seemed to do as accurately as a normal person can. When he was able to walk a more satisfactory experiment was made by blindfolding his eyes and making him approach from some distance one of several persons who called him; in this test he succeeded as well as controls who were similarly blindfolded. His ability to orientate sounds was, as his power of localizing by touch, intact.

Exploration of Surfaces.—Though after walking through the ward or around the large open space in which we frequently examined him the patient could generally say what he had passed, he certainly failed frequently to take cognizance of prominent objects which would scarcely have escaped the notice of an equally intelligent person with normal vision. This was especially so if his attention were focussed on one thing. When, for instance, he was asked to walk across the flat roof toward a tall chimney in the distance he kept his eyes steadily fixed on this and passed—without perceiving them—men, etc., standing along his course. The nature of this phenomenon was investigated by asking him to count a number of similar coins laid on a table, directing in the first place his eyes in such a manner that the images of all fell on the seeing portion of his retinae. He was extremely slow in this test; he generally stared fixedly for a time at one and then moved his eyes about the surface irregularly and unmethodically without making a systematic attempt to explore the whole. When four or five coins were placed irregularly he generally failed to see them all, frequently included one or more a second time in his count, and eventually became so confused that he gave up the attempt. That this was due to his inability to form a clear picture or idea of the spatial relations of those he perceived was made probable by his own explanation, "I seem to lose myself when I look from one to the other," and by the fact that when the coins were placed closely in a horizontal or vertical row he counted them promptly and without difficulty.

His horizontal hemianopia cannot be held responsible for this symptom, as it was frequently the coins furthest from him, the images of which fell on the seeing portions of his retinae, that he failed to perceive. One factor

was that objects outside central vision did not excite attention readily when this was claimed by another visual impression, but it was possible to attract attention to them, for he always perceived each coin and turned his eyes to it, when a pencil was moved above or around it. Another cause was the absence of any tendency to explore even a limited space by sight; he seemed satisfied with that small portion of space included in his central vision, and ignorant or unconcerned with its extension unless some object in it claimed his attention strongly.

Reading.—These disturbances help us to understand his difficulty in reading. When at first he was given large type (Jaeger 14) he read out with hesitation one or two words only, and gave the impression to the observer that his sight was not sufficiently good to allow him to distinguish the print; yet he immediately recognized words in the smallest type (Jaeger 1) quite as easily. Further, he rarely read words in their proper sequence but picked them out at random from the paragraph, and recognized long and unfamiliar words as readily as short or common ones, if his eyes happened to fall on them. When, however, only one word was presented to him he always read it promptly no matter what size the print was, though if shown the whole paragraph he appeared confused and frequently did not for a time identify a single word in it. His slowness in obtaining proper fixation and in moving his eyes over words in their proper sequence was certainly one factor, but his inability to recognize or picture to himself their spatial relations on the page was the chief cause of his apparent confusion; as he said himself, "When I move my eyes from a word I cannot get back to the right place." Later, when he became able to read a few words in sequence he could rarely bring his eyes to the left of the succeeding line—"That's where I'm done, I can't get my eyes down to the next line."

He always understood fully every word and phrase which he read. He wrote without mistakes but his letters to his wife were scarcely decipherable, as the words, though correctly written, were placed irregularly on the page, and the lines were often scrawled obliquely across one another.

Stereoscopic Vision.—It became obvious early in the course of his illness that the patient could not see tridimensional objects in perspective or appreciate depth in them, and this remained unaltered during the time he was under our observation. When, for instance, shown a cardboard box 18 cm. square and 8 cm. deep he described it as a piece of flat cardboard no matter at what angle he saw it, and was surprised when it was placed in his hands to discover it was a box. When its sides were folded down the only difference he noticed was the presence of "lines" which were not there when it was open. Similarly, he could not distinguish between a complete matchbox and the broader side of a similar one which was cut off with half of the striking surface attached and bent into the same plane. A glass tumbler appeared "a piece of flat glass" the shape of which varied according as it was presented to him, and he described his impression of a man who stood in front of him by the words, "I can only see the front of him, I do not notice that he is thick; I cannot tell the depth of anything." He was so objective and honest as a witness that we had no difficulty in ascertaining the nature of his visual perceptions, even of objects which he knew were tridimensional.

He recognized no difference between a book which was fully open and one half closed with its pages at right angles to one another. On one occasion when standing beside a table with his hand on it he remarked spon-

taneously, "I would not know that this is a table by looking down at it; it seems to my eyes to be at just the same level as the floor I am standing on, but when I see its legs and its edges I know it is a table." He spoke frequently of "angles" and "edges," and explained that it was by means of these that he recognized the nature of objects which he saw; "I seem to be able to spot everything that is edged."

While standing in front of a flight of stairs he saw only "a number of straight lines on the floor," and when his eyes were fixed on the ground he failed to recognize steps and differences in level, though by experience he learned to associate shadows and differences in color on the floor with the idea of obstacles over which he might trip and depressions into which he might fall. Houses built on the side of a sloping cliff, one above the other, appeared to be the same distance from him and constructed on top of each other. Drawings and photographs which when fixed in a stereoscope appeared as tridimensional figures to normal persons, as a rule seemed to him flat when viewed in this instrument, though he occasionally described them as figures seen in perspective; but as this occurred even when he used only one eye it was more probably due to the association of a flat image with the idea of the object represented than to stereoscopic vision.

If he was asked to say whether a book held up in front of him was or was not at right angles to his line of vision he frequently replied correctly, but then explained that he knew it was oblique only because he could see its edge. When a sheet of paper was substituted he could never form an idea whether it was held obliquely to him or not; if almost parallel to his visual axes it was "a small piece of paper," and when vertical to them "much longer."

Final Result.—The latest information we have received of this patient was by a letter written on Sept. 30, 1918, that is, four and a half months after he had been wounded; in it he stated, "my sight seems to be quite at a standstill, I'm afraid." When he passed from under our observation most of his symptoms had remained practically unaltered for several weeks and seemed to be more or less permanent.

COMMENT

Our observations on this patient can be now briefly summarized. His chief symptom was inability to orientate accurately in space objects perceived by either central or extra-central vision, and especially to recognize the absolute and relative distances of things seen, though by touch and sound he localized sensible objects as readily as normal persons. His power of distinguishing and comparing lengths and sizes was similarly affected. Stereoscopic vision was abolished; he was unable to see tridimensional objects in perspective and to recognize depth in anything. These symptoms disturbed the performance of various actions in which he relied on sight for guidance.

He also presented a severe disturbance of visual attention, which made him unable to perceive readily or at all objects outside macular vision when his attention was held by that on which his eyes were fixed, and a failure to explore space spontaneously with his eyes; yet objects which threw even large images in his retinae were generally

perceived whole. Further, he was unable to evoke topographical memories acquired in the past and to learn his way in new surroundings. Finally, he had various anomalies of the ocular movements and reflexes, as failure to fixate promptly objects seen, to accommodate near objects, and to blink reflexly to threatening gestures.

His visual fields were reduced by blindness of both lower quadrants, but the acuity of central vision was good. The absence of aphasia and of serious mental deterioration, his intact faculties of motion and sensation, and the fact that he was an exceptionally reliable and objective witness, made it possible to carry out many tests and observations on the nature of the special symptoms he presented.

Certain of these deserve further consideration as they throw light on the cerebral processes which are normally concerned in spatial orientation and in the synthesis of the simpler visual impressions into that physiological product which is the basis of our recognition of, and reaction to, visible objects of the external world.

VISUAL ATTENTION

The disturbances we have interpreted as a local and special affection of attention may be first considered shortly as they do not form an essential part of that complex of symptoms which is of greatest interest in our case, and often occurs apart from and independently of it.

Repeated examination with small objects showed that in the whole of the upper quadrants of his visual fields retinal sensibility to both white and colors was intact; our frequent examinations with the perimeter and with Bjerrum's screen placed this beyond doubt; he could also distinguish familiar objects by peripheral vision. But while his eyes were fixed on anything, he noticed at the most only one other image that fell in the seeing portions of his retinas; when he gazed at the observer's face he could perceive a hand moved on either his right or his left side, but never the simultaneous movement of two hands. Even when he held up his own hands, one on each side of his visual axes, he could see only one, but indiscriminately that to this right or left. If the objects he looked at were small and fixation required attention he occasionally failed, as long as his eyes remained accurately fixed on it, to recognize another object even if near the fixation point. His failure to explore surfaces presented to him, or identify objects on them, and his obvious lack of interest in space outside his central vision were related to this symptom. As he lay in bed or sat in the ward he rarely moved his eyes or exhibited any interest in what was happening around him unless his attention was claimed by sounds, but he always evinced an intelligent interest in all that came into his

macular vision by accident or design. Similarly, on walking he passed unnoticed or collided with prominent objects, though their images fell in seeing portions of his retinas.

This condition has been recognized by several authors and has been recently dealt with by one of us; it is not uncommon as a unilateral phenomenon when lesions involve the cortex of the posterior parietal convolutions. It is essentially a disturbance of visual attention; retinal impressions no longer attract notice with normal facility, and if two or more images claim attention this is liable to concern itself exclusively with, and to be absorbed in, that which is at the moment in macular vision, since such images are naturally more accessible to consciousness than those that fall on the periphery of the retinae. Or, as is more common, when an object in central vision has attracted attention consciousness can take cognizance of one only of a series of other retinal images no matter how conspicuous or insistent they may be. There is, consequently, a restriction of attention, and the feeble call that objects outside macular vision can make on it explain its lack of spontaneity and mobility, and the little tendency it exhibits to direct itself to other visible objects.

Despite the failure of extramacular images to attract attention he generally saw even large objects whole, provided that part of them did not fall on the blind portions of his retinas; this is due to the rule that the mind when possible takes cognizance of unities, unless some detail in them excites special interest. In one experiment, for instance, the patient always recognized a large square drawn on a sheet of paper, but occasionally failed to perceive the whole of it when a prominent mark made in its center arrested his attention.

Head and Holmes have described an analogous disturbance of "tactile attention" when cutaneous sensibility is affected by parietal lesions. Though there may be nc actual loss of sensibility or raising of the threshold only a certain proportion of tactile stimuli applied to the skin is then appreciated, and this proportion bears no relation to intensity of the stimulus provided it remains purely tactile.

SPATIAL ORIENTATION

It is unnecessary to refer again to the numerous observations which showed that the power of localizing accurately in space objects which he saw was seriously disturbed. This symptom was certainly not dependent on the large defect in his visual fields, or on a diminution of his visual acuity, for in the first place he always saw distinctly and recognized the test objects, and in the second, we have seen a large number of men with more or less similar defects in the visual fields who exhibited no evidence of affection of spatial orientation. Some

influence might be attributed to the abnormalities of the movements of his eyes, but it will be shown later that these were an effect and not the cause.

It is evident from our observations that our patient was unable to recognize the actual position of an object in any of three planes of space, that is, its location in the plane at right angles to his visual axes as well as its distance from him. It was, however, only during the first few weeks that he made gross lateral and vertical errors in orientating objects in central vision, though in this he never became quite accurate; but, as Figure 3 shows, he could never point to an object perceived by extramacular vision only. Localization in this plane of space depends mainly on the local signs of the retinal elements that are stimulated; by virtue of these we arrange our visual perceptions according to the arrangements of the excited retinal points, and by this means determine the relation in space of the object seen to the fixation point, and the relative positions in this plane of any two visible objects. Central lesions which affect the local sign function of cutaneous sensibility produce a very similar condition; the locality of a tactile stimulus on the surface of our body can be no longer recognized, though there may be no affection of the threshold of sensibility, or of the quality of the sensation evoked.

An intact local sign system can, however, assure only the correct recognition of relative spatial relations, and relying on it alone we cannot determine the absolute location of objects in space in relation to self. For this we need information on the position of our eyes, the attitude of our heads and the orientation of our bodies in space; only when given these can we form correct judgments on the positions of objects in central vision. Even this faculty was temporarily affected in our patient and probably never became normally acute.

The inability to recognize lengths and sizes and to compare the dimensions of two similar objects also resulted from disturbance of local sign function, as this made the patient unable to estimate correctly the magnitudes of the images that objects threw on his retinae. This judgment was further complicated by his inability to estimate distances, since the magnitude of the retinal image stands in an inverse relation to the distance of the object, but his failure to compare the lengths and sizes of lines and drawings on a sheet of paper proves that the loss of distance perception was not the only cause. Another contributing factor was his difficulty in transferring his attention quickly from one object to another, and in bringing them promptly in succession into central vision; this alone rendered comparison difficult and inaccurate, but it was obvious that this factor had not the importance which the patient himself attributed to it.

It is interesting that he preserved the idea of size and extension, and could indicate approximately the lengths of conventional standards, as a yard, foot, etc., and show the sizes of such familiar objects, as his rifle and bayonet.

His power of recognizing promptly the shape of simple geometrical figures demonstrates that in this we do not naturally depend on the comparison of lines and angles, but that we apprehend shapes as a whole and accept them as unities; only when questions and doubts arise do we resort to deliberate comparison and measurement. Similarly, though when asked to read he frequently paused some seconds before identifying a single letter, he never spelt these out one by one, but recognized the words as totals.

The perception of both absolute and relative distance was, as is the rule in such cases, much more severely affected. Our observations make it evident that his errors in estimating the distance from himself of objects in central vision were very gross, and that even when one was twice as far from him as the other he could not distinguish the relative distances of two objects. His own statement that everything appeared at the same distance from him emphasizes this defect better than any description can.

The nature of this symptom can be understood only when we consider the processes on which the estimation of distances normally depends. This, as Berkeley originally pointed out, is not a simple visual sensation or an innate quality of retinal impressions, but must be an intellectual operation based largely on nonvisual experience, as on the testing and controlling of visual perceptions by tactile and muscular sensations from all parts of the body. Even in adult life we judge distance only by indirect means; by the effort of accommodation and convergence when the object is sufficiently near for these to come into play; by the apparent size when the real magnitude is known; by the difference between the retinal images that the object forms in the two eyes; by the parallax obtained on either movement of the object or of ourselves, and by various empirical data, as clearness, light intensity, etc. Our patient's symptoms cannot be attributed to loss of any one of these elementary physiological factors. It is true that he did not accommodate or converge properly, but as he succeeded in this when he was aware of the distance of the object from him it was obviously an effect rather than the cause; his inability to judge apparent size may have contributed but could not have been the sole reason of such a gross disturbance; while his central vision was sufficiently good to allow him to perceive such qualities as clearness and light intensity, and by central vision he could appreciate the smallest lateral movement.

The cause of his inability to estimate distance must be sought rather in his failure to correlate and assimilate with past experiences those apparent impressions on which perception in the third dimension may be based, and consequently to supply to consciousness the data on which a correct intellectual judgment can be made.

His disturbances of spatial localization were limited to those which depend wholly on visual impressions; he orientated himself and external objects by touch and recognized the origin of sounds quite as accurately as normal persons.

APPRECIATION OF MOVEMENT

The slightest lateral or vertical movement of a visible object could be perceived and attracted attention whether seen by macular or peripheral vision, unless its displacement were directly toward or from him; then he often failed to observe its motion, or could not determine whether it approached or receded. But when its image passed in succession over a series of retinal points it immediately aroused a sensation of movement. Even then the direction of the movement was recognized by extramacular vision only when its range was considerably greater than the normal person requires; the simple retinal faculty of perception of movement was preserved, but the appreciation of the spatial relations of the retinal points excited was affected.

VISUAL MEMORY

Another interesting group of symptoms was due to a special affection of his visual memory. His recollection of the ordinary events of the day and of his past was certainly good; he spoke without hesitation of what had occurred during previous examinations and in the periods between them, and related events of his past life as coherently and intelligently as could be expected from a man of his education. But he could never give us any idea of how he would go from the house in which he had lived for years to the railway station of his town, or to his workshop, which he could only say was close by. "I have no clear picture of it," he complained, "I used to be able to see the way, but I can't see it now."

Further, he did not succeed in learning his way about even when his path was simple; he would often set out in a wrong direction though he had been time after time over the same route, and when asked to return along it, failed to utilize his immediately previous experiences; unlike a blind man he seemed to acquire or retain no memory or picture of the route he had passed along. His inability to determine accurately the spatial relations of objects seen, his tendency to neglect visual impressions that did not attract attention strongly,

and his difficulty in bringing objects quickly into central vision, must have all contributed to his failure to form or retain a distinct idea or memory of his path, but in this he was so much inferior to the blind man, or to a person temporarily deprived of sight by blindfolding, that a further explanation must be sought.

The fact that he did not retain any memory of routes and topographical relations that were familiar to him before he received his injury and could no longer recall them, suggests that the cerebral mechanisms concerned with spatial memory, as well as those that subserve the perception of spatial relations, must have been involved. And as it is predominantly from visual impressions that we form our idea of space, a disturbance in the functions of this mechanism made him, unlike the blind man, unable to utilize or profit by the knowledge of space that he would have otherwise acquired from tactile, muscular and other sensations.

This was probably not a pure isolated loss; to such tests as we employed he seemed to retain simple visual impressions less well than the average normal person, or than he himself retained words spoken to him. The paths and centers which are the physiological basis of visual memory were affected, but it was chiefly those that subserve the retention and recollection of spatial relations that suffered.

STEREOSCOPIC VISION

Stereoscopic vision, or the power of recognizing depth and thickness in solid objects, was completely lost in our patient. Everything appeared to him flat and bidimensional; he identified familiar things only by associating their areal shape with previously acquired experiences, just as the normal person interprets flat drawings as the objects they represent.

This symptom might be regarded as a natural consequence of his inability to appreciate relative distances, since, it might be argued, he could not therefore discriminate the different depths of various portions of a tridimensional figure. But as stereoscopic vision was not affected in any of Holmes' six cases or in other similar ones which have been recorded, although the appreciation of distance was severely disturbed, it is obvious that loss of distance perception does not necessarily abolish it, though it must be a contributing cause. Neither are the muscle changes associated with convergence and accommodation, which make possible the focusing and exploration of the depth of an object, an essential factor, as the patients just referred to possessed stereoscopic vision, though they were unable to accommodate external objects accurately; and as our patient recognized differences in light and shade it is evident that it is not on this alone that stereoscopic vision depends.

These may be all contributing factors, but the essential basis of seeing in relief or perspective is the fusion of the two noncorresponding images that a solid object forms in the two eyes into a single visual concept; like space perception it depends therefore on a higher process in the heirarchy of our cerebral activities than do sensations and simple perceptions. Our patient received such noncorresponding images in his two eyes, and in this sense he had binocular vision, but owing to the cerebral lesion these, when transmitted to the cortex, failed to be properly fused and assimilated with other visible qualities of the images, into a single concept that could give him the idea and power of discrimination of depth in the object seen.

OCULOMOTOR SYMPTOMS

The remaining symptoms presented by our patient were due to a disturbance of the motor and reflex functions of the eyes. There was no palsy of any of the ocular muscles, and he never had diplopia, but, especially during the first part of his illness, he had difficulty in fixing accurately and in bringing promptly into central vision objects which he saw, and in keeping his eyes fixed on a moving point. Further, when anything at which he looked was approached toward his face his eyes failed to converge, he did not accommodate, and his pupils did not contract; he could consequently see nothing distinctly that was within 25 cm. of his eyes.

All these symptoms were secondary to and dependent on the loss of spatial orientation by vision, for they disappeared when he was aware of the position in space of the object which he should fix or accommodate. He turned his eyes promptly and accurately to any point on his own body that was touched, and when his own finger was moved passively toward his face his eyes converged and accommodated on it naturally. There is evidence, however, that this affection of fixation and accommodation is not always directly dependent on loss of spatial orientation; two of Holmes' patients, as well as two similar cases published by Förster and Riddock, were unable to fix their own fingers or bring central vision promptly to points on their own bodies. In some of the recorded cases, too, convergence of the eyes, accommodation and contraction of the pupils did not supervene when the patients attempted to keep their own fingers in distinct vision as they were moved toward their eyes.

Finally our patient failed to react by blinking or withdrawing his head when an object was jerked suddenly toward his face, or to any other threatening gesture. His own explanation that he could not recognize the nearness of the threatening object was probably correct,

as he invariably blinked if his own hand was swung passively toward his eyes, or if the movement of the external object produced an appreciable current of air. The abolition of the blinking reflex in this patient was consequently in all probability due to his loss of spatial perception.

ANATOMIC SITE OF THE LESION

It is not possible in the absence of an anatomical examination of the brain to determine accurately the site of the lesion produced by a gunshot wound of the head, the extent of the damage, or the centers and tracts that may be involved by it, but craniometric measurements enable us to form at least an approximate idea of the portions that are injured.

A necropsy was obtained in one of Holmes' patient, and from this and an analysis of the positions of the wounds in his other five cases and in those recorded by Inouye and Riddock — the only other instances at present known to us of similar conditions due to gunshot injuries — he concluded that this symptom complex appears only as a result of bilateral injuries, and when the lesions on the lateral surfaces of the hemispheres involve the angular gyri or their neighborhood. The fact that more or less similar symptoms have been produced by vascular lesions limited to these portions of the lateral surfaces of the hemispheres (Pick, Bálint, van Valkenburg) and by experimental destruction of this region in dogs and monkeys, by Munk, Schaefer and Ferrier, is evidence that damage of the cortex or subcortical tracts in the region of the angular gyri is the anatomical basis of the condition. The measurements of the positions of the wounds and of the cranial defects in our patient suggest that the missile entered through the posterior portion of the right angular gyrus and made its exit through the upper part of the corresponding gyrus of the left side. Its track consequently conforms closely to that in the other recorded cases in which gunshot injuries produced the same or similar symptoms. We cannot, however, ascertain more accurately the cortical areas and tracts that were involved.

The symptoms we have described cannot be, however, regarded as a direct result of the destruction of centers that subserve the spatial orientation of visual impressions and allied functions, since these functions are not purely sensational, but are the result of the mental synthesis of more elementary visual perceptions, with the afferent impressions derived from the proprioceptive organs of the ocular and neck muscles and from the labyrinths. They should be rather interpreted as the effect of an injury of association paths between those portions of the occipital cortex which are concerned in visual perception and the rest of the brain.

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A PROBABLE ETIOLOGIC FACTOR IN MULTIPLE SCLEROSIS *

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The basis of this paper rests on the observation of six cases of multiple sclerosis. All of the six were symptomatically typical. Two were relatively early, the others were more advanced. Spasticity of both legs and bilateral Babinski sign were present in all; abdominal reflexes were uniformly absent; all, except one early case, showed pallor of the temporal half of each disk; nystagmus and intention tremor were present in all. All had complained of bladder irritability which had appeared early in each instance; incoordination of upper as well as lower extremities was present in all. Sensory symptoms were practically absent. As a discussion of symptomatology is not intended, transcript of case histories is omitted as the symptoms common to all the cases seem to furnish sufficient positive evidence, and negative blood serum and cerebrospinal serologic findings and the clinical progress, insufficient negative evidence to establish the diagnoses fairly clearly without detailed description of the individual cases.

ETIOLOGY

Multiple sclerosis is a disease of youth, or young adult life, infrequently first appearing after the age of 45. The average age of onset in our cases was 36; a rather high average, as one case was 54 at time of onset.

As possible causative agents, acute infectious diseases have been noted, such as typhoid, smallpox, sclarlatina, influenza, whooping cough, acute articular rheumatism, etc. The condition is also said to have developed after the puerperium. Chill, metallic poisoning, carbon monoxid poisoning, alcoholism, injury and violent emotion have all been accorded more or less emphasis. Oppenheim says that in about 50 per cent. of the cases, no cause is evident. In a recent statement Crafts[1] says:

> Close analysis of the commonly attributed etiologic factors . . . must lead to the conclusion that the real cause or causes are as yet really entirely unknown. In what manner can previous acute infectious diseases, such as

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* Read before the Rochester Medical Society, Rochester, N. Y., Jan. 6, 1919.

1. Crafts, L. M.: The Early Recognition of Multiple Sclerosis, J. A. M. A. 69:1130 (Oct. 6) 1917.

typhoid fever or pneumonia, traumatism, exposure or the puerperium act to initiate the development of succeeding foci of gliosis scattered with entire abandon throughout the sphere of the central nervous system, occurring, receding, with apparent clinical recovery, latent perhaps for years, again and again recurring, and receding throughout a course of great chronicity? In what manner is it possible for these long past incidents to so affect the organism as to cause the repeated turning into the blood stream of some genetic agent, probably autotoxic in nature, to attack here and there limited patches of white or gray matter, destroying the myelin sheaths, leaving the naked axis cylinder and the cells largely intact and functioning, although suffering to some extent degenerative effects?

In referring to a possible infectious origin practically all writers appear to refer to the occurrence of an acute infectious disease in the past rather than to the continued action of a long existing source of infection, though an occasional hint that such a possible source should receive more consideration has appeared in the discussion of certain recent papers.

With regard to etiology, it is practically impossible at present to study this condition satisfactorily from the experimental viewpoint, because of the fact of the very slow progress of the disease suggesting as it does, not the result of an acutely active process, but the result of some agent exerting a prolonged gradual influence interrupted by periods of exacerbation and remission. The chief evidence at present must be gathered from controlled clinical observation and tissue study. The former method was directly possible on only four of our patients as two were unwilling to pursue the plan recommended. The six patients had had the more usual diseases of childhood, but there was no outstanding evidence of probable causal relationship apparent from any of the histories.

These patients were studied primarily without reference to any theory of etiology, and as they were admitted over a period of five years, it was not until several of them had been under observation that we had sufficient data to offer a likely etiologic lead. The only possible etiological condition regionally common to all was some type of inflammatory disease of the upper respiratory tract. Such a coincidence might, however, occur very easily in any consecutive small number of cases in view of the prevalence of such conditions. That every one of the six patients had obviously chronically infected tonsils seems to be worthy of note. This was the one pathological feature in addition to the disease of the nervous system which was common to all, and the only one which seemed to us to give any definite inkling of etiology except that five of the patients had also — as dentograms revealed — peridental infection. This, however, was not strikingly extensive, either in the number of teeth involved or the degree of involvement. No dental observations were made on the other case.

In our opinion no tonsil is properly observed until a clear view has been obtained of all its free surfaces and firm pressure has been applied in an attempt to express free pus. Abscesses may in many instances be ruptured by pressure with the spatula tip, and tonsils showing vascular engorgement, adhesions, or exudative plastic covering ought to be carefully examined.

PATHOLOGY

In reference to the pathology of multiple sclerosis, Schlesinger says, in part:

> In the foci one finds upon microscopic examinations no, or only a few, nerve fibers retaining their medullary sheath. But many well-preserved axis cylinders pass through the foci. The neurogliar tissue is extraordinarily increased, and forms a thick felt-like layer, which does not show any tendency to softening anywhere. The ganglion cells, even in the center of the foci, are not injured, but the vessels often show grave changes; their walls are thickened and the lumen narrowed, or even entirely obliterated. Secondary degenerations are absent, even after long continuation of the disease, and with numerous foci. Upon the advent of diffuse sclerosis, changes in the form of the sections attacked, especially in the pons, occasionally occur.
>
> Besides the old foci, one frequently sees diseased spots in which the process is of more recent date; small-celled infiltration of the vessels is exhibited.

Orr and Rows,[2] as a result of their experimental work, sharply distinguish the pathological types resulting from different routes of infection in the central nervous system. They first recall the fact that there are but two ways of producing inflammatory changes in this system. The one is by way of the lymphatics, the other through the blood stream. Toxic or microbic invasion by way of the lymph pathways produces a primary inflammation of the fixed tissues, whereas infection of the brain or cord by way of the blood stream produces a totally different picture, showing remarkably little evidence of inflammatory changes in the fixed tissues, the areas of degeneration of medulated fibers apparently being associated with vascular changes. They further state that nonsystemic lesions occurring in the spinal cord are characterized by atrophy of the myelin sheath and sclerosis, and appear to be dependent on some toxic condition of the blood stream. They did no work with multiple sclerosis, but their conclusions are of obvious significance in this relation.

None of our patients have died and I can obviously give no necropsy record of them. I have, however, been much interested in the study of some sections from a case of multiple sclerosis. These sections were prepared in the neuro-pathologic laboratory of the

2. Orr and Rows: The Interdependence of the Sympathetic and Central Nervous Systems, Brain, Lond. **41**: Part 1 (June) 1918.

Charité in Berlin. Dr. S. T. Nicholson has kindly made careful observations and camera lucida drawings to scale from these sections, giving special attention to the vascular and perivascular conditions. The rest of the sections correspond in general with the pathologic description already quoted. Dr. Nicholson's report is as follows:

Description (General) of Vascular Condition in Area of Sclerosis from Slide of Multiple Sclerosis.—1. Blood vessel walls are thickened with lumen constricted.

2. Vessels are infiltrated with small round cells in the adventitia.

3. Organization of inflammatory infiltration almost obstructing the lumen of certain of the larger vessels (compare illustrations).

4. Necrotic (acid-staining) areas in perivascular region which according to Schlesinger are fatty granular cells filling the adventitial lymph spaces.

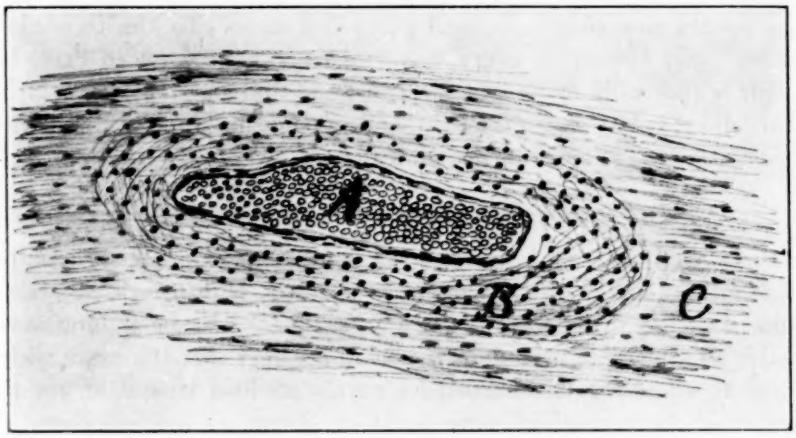

Fig. 1.—*A*, lumen of vein filled with red blood cells; *B*, circumscribed area of infiltration around vein, consisting of round cell infiltration and very early fibrous tissue; *C*, sclerotic tissue.

COMMENT

It seems evident that the lesion in certain cases of multiple sclerosis is at least in part inflammatory, and that the type is very strongly suggestive of a process spreading by way of the blood vessels, and that a very essential element in the picture is the pathology of the vessels themselves. The wide irregular distribution of the lesions would certainly point to a probable origin by way of the blood stream.

We have then a small series of cases all showing ample preoperative and postoperative evidence of tonsillar infection. We have further a probable common general pathology in the central nervous system which is perhaps dependent on some type of poison in the circulating blood. This evidence is certainly far from positively conclusive,

especially as we have isolated no organism not common to other tonsillar infections; but it is as far as we can go at present except as the progress of the cases is of significance.

Four of these patients had their tonsils removed; the other two refused. Of the four, all had later, or are having their dental work attended to. Reports have been received from all. Two relatively early cases report themselves as "well," despite the fact that both had previously been greatly hampered by motor incapacity and bladder trouble; one of these developed infected antra after the extraction of peri-abscessed teeth, but reports a favorable convalescence. One begins her last report, a year after we saw her, as follows: "Perhaps you remember Mrs. N. I am she in name, but in no other way, for I am just as well as I never hoped to be," etc. In one rather advanced case, four months after observation, the patient is walking without a cane for the first time in several years and states that she feels more "limber" and "better in every way." In another advanced case, the patient walks with much greater ease, one and one-half years after observation; is less easily fatigued, and pursues his work in the lumber business daily. These four are all leading active, useful lives.

USUAL RESULTS FROM MEDICAL TREATMENT

I am well aware of the striking remissions and apparent cures which may occur in cases of multiple sclerosis, with or without treatment. I incline to the view, however, that there may be a significance relative to a possible infectious origin in the fact that the cases which appear to show the best record on purely medical treatment are the ones which have received some form of arsenic or the salicylates, or both.

RECENT LITERATURE

At a meeting of the Chicago Neurological Society in January, 1917, Dr. James C. Gill reported a case of multiple sclerosis, in which the diagnosis was concurred in by Dr. Peter Bassoe. This patient showed apparent recovery after the elimination of peridental and tonsillar infection and was evidently reported to emphasize a possible infectious etiology.

The recent painstaking pathologic studies by Klingman,[3] and the illuminating paper by Spiller[4] appeared subsequent to the preparation of this paper. Both these communications lend weight to the histogenetic theory of multiple sclerosis, but Spiller clearly admits and

3. Klingman, Theophile: The Histogenesis of Multiple Sclerosis, Arch. Neurol. & Psych. **1**:39 and 193 (Jan. and Feb.) 1919.

4. Spiller, W. G.: The Subacute Form of Multiple Sclerosis, Arch. Neurol. & Psych. **1**:219 (Feb.) 1919.

seems to favor the theory of a possible secondary infectious element of some type, perhaps syphilic, in certain instances. Klingman's paper, while strengthening the evidence of histogenesis, does not appear conclusively to eliminate a coincident inflammatory process. One questions whether certain cellular elements which he covers by description may not actually furnish evidence of small round cell infiltration.

CONCLUSION

I would say in conclusion that certain of the pathologic evidences taken in conjunction with the uniformity of certain of the clinical observations and the apparent results of treatment in these few cases would seem, in consideration of the otherwise indefinite state of our knowledge regarding the etiology of multiple sclerosis, to warrant laying some stress on the desirability of clearing up whatever areas of infection can, on careful study, be discovered. The theory of a possible localized infective source, distributing its toxic products through the circulation furnishes an hypothesis which would appear to meet the arguments on' which Crafts, in the statement quoted, largely bases his contention that no etiologic explanation available appears adequately tenable.

EXPLANATION OF PLATE

Fig. 2.—*A*, adventitia; *B*, media; *C*, intima; *D*, vacuoles; *E*, early fibrous tissue (fibroblasts).

Fig. 3.—Arteriole filled with red blood cells with areas of round cell infiltration adjacent to vessel wall (chronic inflammatory process). From slide of multiple sclerosis.

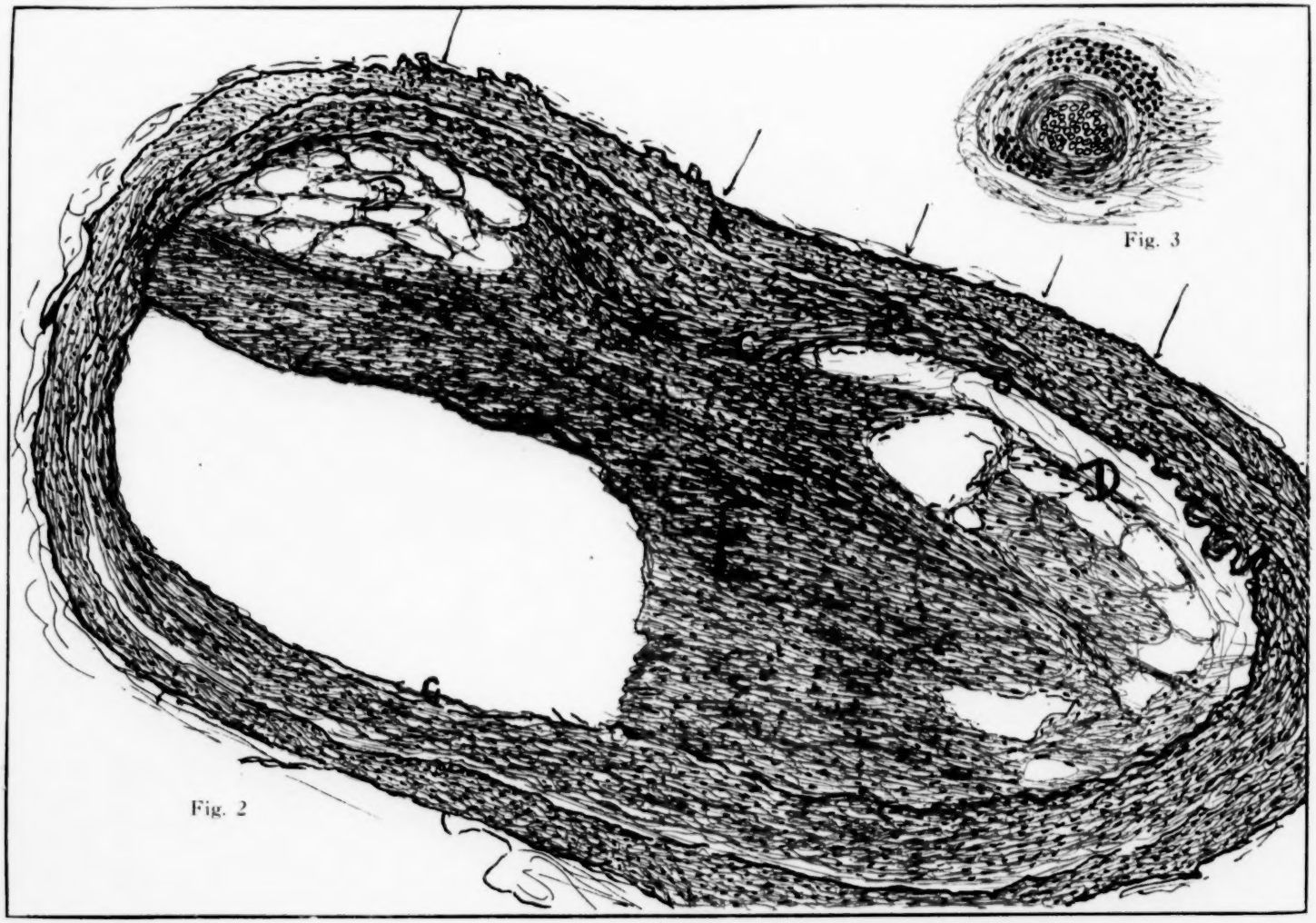

Fig. 2

Fig. 3

A CLINICAL STUDY OF PSYCHOSES CHARACTERIZED BY DISTRESSED PERPLEXITY*

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In this article it is our desire to put together seven cases which presented as the most prominent symptom a more or less pronounced perplexity associated with distress, and we hope to demonstrate that these cases represent a definite reaction type.

The observations were made in part at the McLean Hospital, Waverley, Mass., by Dr. Hoch; but the greater part are cases which were studied at the Psychiatric Institute, the observations before 1910 having been made by Dr. Kirby, the later ones by Dr. Hoch or under his direction.

We shall first give a description of the cases. Since it is impossible for want of space to give them in full, we shall present abstracts, in the preparation of which great care has been taken so that a concise and yet complete picture of each case should be available.

CLINICAL MATERIAL

CASE 1.—Caroline J., aged 45, single, was admitted to McLean Hospital Nov. 28, 1900.

Family History.—One sister and one brother had depressions past middle life from which they recovered. The parents are said to have been normal, and all psychopathic tendencies are denied, even in collaterals, with the exception of a maternal uncle who was dissipated.

Personal History.—The patient is a well-educated woman who is said to have been rather unusually sensible and capable. She never had a former psychosis. No cause is known for the present attack, and since the patient menstruated regularly during her whole attack, there is no evidence of the menopause as yet. For some months before admission she was a little tired. For one month she slept poorly, had a poor appetite, and became physically run down. The real attack began only about two weeks before admission. After recovery the patient said it began rather suddenly with the feeling as if everything left her. The brother told us that she became very undecided and depressed, and worried over trifles.

Under Observation.—For about six weeks the patient was in a constant state of perplexed uneasiness, with considerable restlessness. This latter trait always remained within certain narrow limits, showing itself in her constantly moving her hands—pulling at her clothes, brushing herself, and also making meaningless motions with them. She spoke herself of "feeling all confused"—"I can't tell anything about anything, I am so confused"—"I don't feel straight"—"I can't grasp things." Although it was often possible to get her

* From the Psychiatric Institute of the New York State Hospitals.

to answer trivial questions readily enough, practically nothing was obtained, except the answers just given, whenever her worries were inquired into. She hesitated much, started and stopped without getting anywhere, or she said directly that she could not tell what she worried about; "I can't tell. I can't even tell how I feel—too many things." On another occasion she said, "I can't tell, it is too hazy." Indeed, even when she was better, she said she was unable to tell what she had worried about, because it was too vague, that she could not describe it, but she always denied that she was afraid at that time.

It was only in the very beginning of the observation that she told her nurse a few more definite things. Thus, she said that she felt it would ruin her sight if she had a movement of the bowels. Again, she thought her urine did not come out of the right place. A certain feeling of guilt was also expressed on the first day when she told the nurse not to touch her; "When an honest person touches me I feel as if I were not honest." Referring to the same period she said retrospectively that she could not go to the toilet at that time (she did resist in that respect), because she thought she had a miscarriage; and she also thought she had embezzled some money as treasurer of a mission. But she again added that the main worry was vague, and these more clearly formulated ideas were evidently not present later.

Whenever orientation questions were asked or when she was asked to perform certain intellectual operations, one met with statements such as that she did not know, that the days were mixed up. But it was invariably found that she was quite clearly oriented, and retrospectively she knew many details of what had happenned around her. Her calculations were usually slow but correct.

When this perplexity faded, it gave way rather quickly to a simple depression. The patient herself later said, "It seems as if I lost my will power as I got quieter." From then on a prominent feature was a pronounced feeling of inadequacy; "I can't seem to make up my mind to act"—"I have great difficulty in doing things," etc. Another feature was a feeling of unreality of moderate degree: "Things don't seem quite real"—"After you are gone it wont seem that you have been here." She complained of her affection for her family being diminished; "My sister seems far off"—"I don't even feel hunger, heat or cold as I used to." She worried now entirely about her condition.

Four months after admission she was discharged almost recovered, and soon recovered completely.

Case 2.—Mary D., aged 57, married, was admitted to McLean Hospital Feb. 21, 1903.

Family History.—Father had a "melancholia" in advanced years. One sister had a "nervous breakdown."

Personal History.—It is claimed the patient was of a normal disposition. In connection with the menopause at the age of 47 she had a psychosis which lasted six months. It began suddenly with the idea that she was to be carried off. All that is known about the attack is that she was restless, paid little attention to her surroundings, and spoke at times of an electric battery in her. She made a perfect recovery.

Present Attack.—Three weeks before admission, after a fatiguing care of her sick husband, she is said to have had influenza. A few days later she became sleepless, worried about her husband, cried much, thought she was going to have various diseases. She spoke of hearing a telephone, became restless, said she wanted to die, was losing her mind and kept repeating,

"What shall I do?" At other times she is said to have been quieter, with some insight into the morbid nature of her ideas.

Under Observation.—For ten days the patient showed a marked perplexity. She was uneasy, restless, her facial expression showed bewilderment. This was also expressed in various utterances: "I am confused"—"I can't understand things"—"I am dreadfully mixed up"—"It is a mystery"—"What is the matter, am I silly, or am I crazy?"—"I don't know what to do"—"Will they take my mind away?" She also said her mind was weak and "I can't seem to remember." In addition to that she said, "Nothing looks natural"—"Everything looks alike." Then there was a peculiar feeling of reference: "Every little thing seems to have a meaning"—"Why do the nurses go out?" A vague feeling of guilt was expressed in the following: "Have I done wrong?"—"What do they mean by saying I stole money?" Again she said, "I have been wicked."

A few more peculiar ideas were expressed: "What do they mean by saying that I turn into two girls?" Or again, "They tell me that I have glass eyes all over."

As regards her orientation and intellectual operations, it may be said that she knew she was in McLean Hospital, but sometimes asked if it were not the X hospital. She knew the name of some physicians and in a general way the dates and how long she had been in the hospital. But she seemed unable to calculate or to give a good account of her life when this required an intellectual effort. She could not do correctly more than simple multiplications, was unable to take 7 from 100 consecutively, could not calculate the year of her birth in spite of knowing her age and the present year, could not give the date of her marriage or the birthdays of her children.

At the end of that time the patient became less perplexed but cried at times; said she was going to die. This condition was followed after a few days by a period in which she was often quite natural, at other times a little irritable, or again homesick, with considerable insistence on being allowed to go home, and now and then crying. Retrospectively the patient said that she felt confused at first, that nothing looked natural, everything looked alike and that for this reason she thought she could not see right. But a careful inquiry into her actual capacity of elaborating impressions at the time of her psychosis was not made.

She was discharged, recovered, March 26.

Case 3.—Polly V., aged 37, married, was admitted to the Psychiatric Institute May 4, 1916.

Family History.—It is claimed the family history is negative with the exception of the fact that one brother had an attack of insanity from which he recovered.

Personal History.—The patient is a Jewess who was born in Prussian Poland, emigrated to England and later came to the United States when 25 years old. Her people are decidedly ignorant and it is difficult to get a very reliable account of her make-up; but she is said to have been rather quick tempered, lively, fond of amusements a good mother and a good wife. She was married when 20 and has six living children, the youngest 2 years old.

For several months before admission the patient was rather nervous, easily frightened and fearful about her children. Three months before admission a cousin and his wife came to live in the same house in which the patient was janitress. A few weeks before admission this cousin began to complain to the patient about his wife; when the latter heard this she came to the patient

(about a week before admission) and made quite a scene, during which she pulled the patient's hair, and it is claimed that the latter fainted. Moreover, this woman complained to the landlord that the patient was not taking proper care of the house, and she got several other women to turn against her as well. They now threatened to report her to the board of health and to the charities department for not keeping the house clean. They scared her also by telling her she would be sent to prison. This made the patient very nervous, but it is claimed that she got some comfort out of the landlord's writing to her that he would come and investigate the matter and if the complaints had no foundation he would send away the other women. When at the appointed time the landlord did not come, the women gibed her and she was much upset and again fainted. This was only a few days before admission.

She was then sent to her brother's house. There she said she had to go to prison, to the electric chair; again, that she was going to die.

At the Observation Pavilion she is described as distressed, hearing her children, saying her children had been taken away from her.

Under Observation.—The patient for the first six weeks showed much anxiety, distress, and crying, often with more or less restlessness. At times she was somewhat absorbed when left to herself, and there was little occupation at any time. Occasionally the statement is made in the notes that she was a little bewildered, but this is rare and, in spite of the fact that many notes were made, is never substantiated by any definite statements on her part of a feeling of perplexity. All her utterances referred chiefly to her children and her anxiety about them: "Will I ever see my children again?"—"My children have been taken away." More frequently she spoke of them as having been killed: "Somebody killed my children; they do not need any mother any more"—"They killed my children. Did they deserve to be killed? They were good children." Or she claimed she had seen smoke and knew it meant that her children had been burned, or from the window she had seen them in the water. Again, when moaning or crying was heard in the ward, she often thought it was her children who were being killed. She was, however, not always fully convinced of this. Once she said, "If my children are dead, I don't want to live any more." Less often she feared that something had happened to her husband: "My husband is sick. Is my husband dead?"—"Is my husband not dead? I think he is in the water." And once when she spoke in this way about him, she added, "Is my mother killed too?" Twice she dreamed that her whole family was burned to death and was quite stirred up about it in the morning. At one time she said quite placidly, in strong contrast to the usual distress: "I wont live with my husband any more. I am going to send him to California. I don't want to have any more children." On the other hand, the ideas about her children were also formulated in a different way at times, namely, in the form of self-accusations or in the form of accusatory voices: "I deserve to die on account of not taking proper care of the children." Quite frequently she repeated, "I deserve it, I deserve it," or, "They are going to kill me because I say I don't want my children"—"They think I am not a good mother." In the beginning she heard her children at night say, "Mother, mother, you were not good to me." Again: "They say they did not want me any more, that I did not give them enough to eat." Or: "I did not care for my children, I did not clothe them, I did not feed them enough."

Repeatedly she said, "I am going to die," or "I am going to be killed," and it was quite striking that in contradistinction to the usual distress this was said as a rule rather placidly.

With all this there was associated not infrequently a peculiar "sensory-unreality complex": "There is something stiff in my mouth. My whole body is stiff. When I get my hand, I don't feel it." Or: "I don't care for my children. Did you ever hear anything like that?" (all this with marked distress). "I forget the faces of my children"—"Sometimes I can't remember my children. I forget all about my home." Again, "I can remember a little about my children." In connection with some of these utterances she once said, "I don't know what happened to me."

The test for orientation and for her capacity for intellectual operations during this entire period gave rather striking results. For an interpretation of these it is necessary to keep in mind two factors, namely, the patient's distress, and her illiteracy, and her probably low mental level. For example, she was never able to read the watch correctly, and she was not able to say exactly how much money would be left if she went to the store with a dollar and bought something for a certain amount. She invariably said she never had known that. Dates were difficult to obtain from her. Yet at the same interview she could tell how old her children were when the family came to the United States. The most striking fact was perhaps that she sometimes gave very absurd answers about her whereabouts; for example, she asked at one interview whether this was not Minnesota, yet during that same interview she knew exactly how long she had been in the hospital. On another occasion she called the place Castle Garden, again London, again America. She never could give the sequence of the months, but at an interview at which she gave very defective answers in this respect she knew it was summer and knew about how long she had been in the hospital. At another interview she said it was a hundred years since she came, but at the same time gave the ages of her children correctly. She always claimed not to know where she came from (the observation pavilion).

It is obvious that the significance of these peculiar answers is difficult to interpret, although the two factors first mentioned undoubtedly have an important bearing.

By the end of June the picture suddenly changed. She developed a peculiar motor excitement, with many purposeless, shaking, rubbing motions. During this she began to say, "I don't know what is the matter, I can't understand anything"—"I don't know the whole trouble," all this being repeated over and over, and there was only on one occasion an approach to the former content when she said, "I want forgiveness for my children." This reached its climax during a still greater restlessness in which she threw herself about in bed and against other beds and blindly shouted "police! police!" During this condition her physical health became poor and about ten days from the onset she was found with coated tongue, high pulse and tremulous motions, but she was markedly unresponsive and kept up a constant unmodulated moaning. The only thing she said at times during this interview was, "I know there is some trouble." Henceforth she was changed.

During the period that followed, that is, from July, 1916, to June, 1917, when the observation ceased, the patient did not change materially. She was now in a decidedly perplexed state; for the most part, sat around or walked about slowly with a perplexed frown on her face, and only at times during brief periods did she become more stirred up. The most prominent feature in the picture was that of her frequent statements denoting perplexity: "I don't understand"—"I don't know what is the matter"—"I don't know what has happened to me"—"How can I understand it? I thought they were doing

something bad to me"—"Everybody says something and I can't understand"—"I know there is something the matter with me"—"I know there is trouble"—"I don't know—they are talking something"—"What shall I do when I can't understand?"—"I don't know what people say to me"—"I don't know what is going on"—"In the morning they pull me, everything is pulling me, I don't know what it means."

The only approach to the sensory-unreality complex of the former period was seen in the following: "I can see but I don't understand what it means"—"I think my eyes spoil everything." Again she said, "My eyes are spoiled, I can't see."

To a much smaller extent depressive ideas came out at times: "I know I am no good"—"I don't belong to this place"—"It is too good a place, it is a place for people who know where they are." Or once when the doctor said to her, "Don't worry, you poor woman," she said, "I am not a poor woman, I am bad." Whereas in the former condition she said a great deal about her children, this was very rare and occurred only on a few occasions when she said such things as "They took the children away"—"They said I don't take care of my children." It was interesting that at such times she cried, which was not the case on other occasions. One night she got quite excited and claimed boats were on fire.

It is rather obvious from what has been said that nothing further could be discovered in regard to her thoughts. Whenever one wanted to find out what really bothered her or what her ideas were, one was met with her usual statement that she did not understand, that she did not know what was going on, and the like.

Similar statements were made when one tried to get at her capacity for intellectual operations and her orientation. Nevertheless, on persistent questioning in this direction, it became more and more clear that she knew the name of the hospital, the names of those about her, knew the time of the year, in spite of the fact that at first she often said she did not know. On another occasion she was able to give the names and ages of her children.

After this time the patient was transferred to the general wards of the Manhattan State Hospital. A report of July, 1918, states: From the observations made by the ward physicians it is evident that there has been no marked change for some time. In regard to her condition now, the nurse says the patient sits about the ward in a rather disinterested manner. She never speaks unless addressed and she never does any work. Whenever she gets a chance she wanders away. The reason she gives for running away is, "I am looking for my six children." In the ward she has to be urged to eat; however, she appears to be quite well nourished. She keeps herself fairly tidy and the nurse reports that she has recently improved in this respect. She does not wet or soil, and she does not have to be dressed or undressed.

On examination by Dr. Kirby the following was found: When interviewed, she is observed to be in a rather constrained attitude, her right hand being flexed and held rather awkwardly across the chest, the left hand resting on the chair by her side. She has a somewhat dazed, bewildered facial expression. When asked about her health, she replied quite promptly, "I don't know, I am not sick," and she then went on as follows: "I don't understand anything, I don't know what to tell you, I'm not sick." When told to put her hand down and assume a more comfortable position, she resented being touched and pulled away in a half-annoyed way, saying, "Don't touch my hand." Asked to give the name of the nurse, she says "Miss

Goldberg," and smiles. The nurse's name is McGoldrick and a good many of the patients really call her Goldberg. When asked if she knew the examining physician, she replied, "I don't know if that man is a doctor." At this point, when asked if she could smile, her face brightened up, she smiled a little and said, "I'm not sick." When asked about wanting to go home, she said, "I must go home with my husband, not with a strange man," and her eyes filled with tears.

She gives the day of the week correctly, knows the number of the ward in which she sleeps. Asked to give the name of the place, she persistently says, "I don't know," and later says, "I must go away now," moves to the edge of her chair and seems a little afraid. This becomes more marked when the nurse leaves. When asked where she formerly lived, and how she was taken away from home, and so on, she simply replies, "I don't know," without apparently making much effort, although she does not seem apathetic —on the contrary there is evidence of certain emotional tension throughout the interview and she makes frequent references to home. (What are the names of your children?) "I don't know." When the physician says in a surprised way, "What!" she replies, "The bigger one is Rachel and the other one is Judith." Asked, "Why did you say you did not know?" she replied, "I didn't know what to tell in English."

To all the rest of the questions asked she is apt to say, "I don't know." (Is your head clear?) "I don't know." (Are you troubled about anything?) "I don't know." (Are you happy or sad?) "I don't know. I am not happy—why should I be happy?" (Why do you at times try to run away?) "To look for my children—my girl told me (in a letter) to go home and I don't know where to go."

She is inclined to turn away from the physician and seems anxious to leave, and finally gets up and walks away. When passed in the hall by the physician she said, "I'm not sick; I must go home to my own children."

CASE 4.—Ida S., aged 25, married, was admitted to the Psychiatric Institute June 20, 1913.

Family History.—The sister-in-law says that both parents are living and are well.

Personal History.—The patient attended school very little, but can read and write. Practically nothing is known of her make-up, except that she was a good housekeeper, naturally cheerful, not worrisome, always helpful to others. She married her uncle (mother's brother) seven years before admission. Her first child was born six years before admission. The birth was uneventful and no mental upset followed it. It is said that she never complained about her husband and never had any ideas of jealousy about him.

About a month before admission she was confined and the labor was easy. For three days after childbirth she was normal. On the fourth day she had a fever which lasted only a day.

About three weeks before admission she got depressed, said she would never get well, was very sick, had lost all her blood (she was flowing). Sometimes she did not answer questions; again was irrelevant. Finally, she said everybody was talking about her sickness; that detectives were watching her. It is also said that she tried to inhale illuminating gas.

Under Observation.—On admission the patient was well nourished, but she had a subfebrile temperature for a few days, dry lips and a coated tongue. She sat up in bed, somewhat distressed, whining or crying, sometimes when she heard sounds she looked about somewhat frightened; at times she was aim-

lessly resistive, or again she appeared rather sullen and had a somewhat dazed expression. She either did not reply to questions or answered by saying, "I don't know," or she wanted to be left alone; but when urged she would talk quickly enough. She then complained of not being able to breathe well, gasped, said her lips were dry, that her skin itched, that she wanted to go home. Her orientation was not established on account of her attitude.

For about three months following a day or two after her admission, the condition was as follows: There was considerable restlessness, associated with a mood of perplexed distress and often considerable talkativeness. Her productions were often poorly arranged and many sentences were left unfinished. Her perplexity in addition to being evident in her facial expression and manner, also manifested itself directly in such frequent statements as these: "I am all mixed up"—"I don't know where I am"—"I don't know how long I have been here"—"Everything is changed"—"There is no day or night"—"A thousand names have been given to me," etc.

For the rather disconnected talk, uttered with the foregoing described affect of perplexed distress, the following is characteristic (it should, however, be added that she is not fully conversant with the English language):

"Now they say the whole place is dirty—but now its people put here—poor people—and now they say whoever goes out and down below—there is an awful lot to be said—I couldn't remember exactly, and they say a whole lot and they all have to go to court—and of course they are all chasing me, out here—and a lot to be said—I am not sure of his name, he don't belong to me, my companion," etc.

The essentials of the trend which she thus produced were as follows: "There are lots of people here, good friends and bad friends"—"Half of the dead people they took out here"—"I see a whole crowd that got burned"—"The whole world is here"—"Half of New York is here"—"All the people are changed"—"Some house burned"—"They are all burned down"—"Too many people against one person."

Most of her ideas evidently came to her in the form of hallucinations of hearing and were chiefly of an accusatory character. She was blamed for various wicked things, and in her perplexed and distressed manner she kept protesting and denying them. The sexual accusations of which she spoke occurred more particularly in the first few weeks.

She said people were talking about her. Often the whistling of the boats and the footsteps of others seemed to be connected with such voices. Thus when a boat whistle was heard, she said: "See," or "That hurts me—from mouth to mouth." "She is called a thief, a crook; some buildings are burned, and she is blamed for it." "One time my name Ida, Ida, Ida—now that was —what can I do?"—"They all say it is my fault"—"The whole crowd is putting the blame on me"—"Everybody is suing me"—"People call me a whore"—"They say Ida is a whore for business"—"They say I had relations with men." Some of her perplexed protests were as follows: "I am respectable"—"They can't blame it on me" (in connection with her saying that a whole crowd got burned). Again: "Why should I go and be bad?"—"Everybody says something different"—"How can one person be for everybody?"—"I have to be bad and it is not my nature"—"My heart and soul say I am married—so many people for one person"—"But they ain't my husband."

Then she also said much about peculiar bodily sensations and bodily changes: "I am getting deaf and dumb"—"I am getting sores; I never had any sores on my body"—"The whole body itches"—"I cannot breathe, my

lips are dry"—"My blood is poisoned"—"I never sneeze, I never cough"—"My body is killed"—"My womb is twisted, some say it is due to childbirth, others say it is due to immoral life."

In spite of her frequent statements that she did not know where she was, that there was no day and no night, etc., it was found that when one could break through this mental attitude sufficiently, she knew more than would be indicated by her spontaneous utterances. Thus she knew this was a hospital on an island, knew she came on a boat, had at first been in a ward down stairs (correct). She gave approximately the date and the year, understood that one of the examiners was a physician, but was apt to be uncertain of the other, whom she called Harry Leon (a neighbor whom she knew only by sight).

From this more agitated state she gradually calmed down and for several months lay in bed, quiet, or stood or sat about with a rather doleful expression, at times whining, considerably reduced physically (six months after admission 36 pounds under weight), sometimes having a fetid diarrhea, and a rather swollen, red tongue. She now began to soil herself, was inactive, said little, often only shook or nodded her head when questioned, but she spoke quickly enough at times when sufficiently urged; often, with a rather disgusted air, she said she wanted to be left alone, or answered she did not know or did not care. The prominent content now was that she felt sick, dirty, that she was disgusting, covered with feces, rotten inside, that she will die, has poisoned herself, has no body, no eyes, no teeth, no husband, no children, is no good to anybody, is crazy.

Following this she became more active; at the same time her weight increased and she gradually returned to her natural state. Nevertheless, even nine months after admission, she was still languid, though without peculiar ideas.

An examination a short time before her discharge showed that she appreciated fully that she had been mentally unbalanced, but on account of her lack of education and rather low intellectual level a good retrospective account of the psychosis was not obtainable. It was, however, possible to demonstrate that many details of what happened in the hospital during her perplexed period were remembered.

Case 5.—Elizabeth S., aged 28, married, was admitted to the Psychiatric Institute Nov. 24, 1914.

Family History.—Sister denies all heredity, but it was later found that a brother of the patient is wayward.

Personal History.—Both the husband and the sister claim that the patient was lively, made friends easily, was fond of amusements, and was in no way bashful or timid. On the other hand, it is also known that in childhood she often used to wet her bed, and later she not infrequently had fainting spells during her menstrual period.

Up to her marriage she worked as salesgirl, nursegirl, and lady's maid.

She was married three years before admission. After her marriage she again began to wet her bed at times and had five or six fainting spells since that time. Several of these occurred on the street, so that she had to be taken home in an ambulance.

The following incident should be mentioned at this point, because it plays a part in the later content of the psychosis: After marriage the patient at times worked for a woman, Mrs. D., doing sewing, and the like. This woman evidently was of a somewhat questionable character. About three years before

admission she made the patient a present of some silver spoons and forks. When the patient looked at these at home she found from the stamp on them that they evidently had not belonged to Mrs. D., but were the property of the hotel in which the latter lived. This upset her considerably, and she told her husband about it. She did not dare to return the articles to the hotel for fear that she might then implicate herself in the theft, and therefore hid them. The woman was also immoral, as the husband states, and about six months before admission he forbade the patient to associate with her.

Attack.—Eleven days before admission the patient told the husband that another woman (Mrs. M.) for whom she sewed at times, had had some towels stolen from her and that one of the servants told her that she (the patient) was suspected. (Later inquiries by the husband confirmed the correctness of the fact that the patient was told this.) After a day or two the patient became considerably upset about this and talked about being accused of stealing. The husband then took her to the theater in order to divert her, but there she became quite uneasy, said people were talking about her, were calling her a thug. Next day she fainted on the street and was taken to a general hospital, with the statement that she had "carbolic acid" poisoning. There it is stated that she claimed not to have taken "carbolic acid." She was depressed and imagined everybody was against her. She was discharged the subsequent day and sent to the observation pavilion. The notes from the latter place describe her as worrisome and restless, and as saying that the whole world was against her, that everybody was making fun of her and wanted to get her out of the way.

Under Observation.—For six weeks the patient presented a condition which was characterized by a more or less pronounced restlessness which manifested itself at times merely in a certain tenseness, but sometimes by twisting her fingers, pulling at her hair, walking up and down, biting her finger, and the like, and not infrequently by a certain uneasy talkativeness. What she said at such times was often poorly arranged, with unfinished sentences and much repetition, so that it was often quite impossible to understand what she was talking about. A few samples may illustrate this: "Are you a Catholic? You know I did not do anything wrong to anybody. You know I went to the place, I went to the theater and they said that I—I went to the theater—I never did anything wrong in my life—they said—you took me for a person that I was not, I never did anything in my life—I am innocent, innocent, innocent. I never hurt anybody's head in my life—what are they trying to do to me?" etc. Or, "I didn't accuse myself of anything—I am not—I only knew but one person—a woman told me one time that—the only one I knew about is Mr. B.—there was a woman one time said he was responsible for some girl's death, I don't know anything else—they said—the girl—the girl—that girl—they said she—she—I don't know—there was something queer—they said—that is the only thing I know about, I know nothing about anybody else—" etc.

There were many utterances which denoted a certain sense of confusion or perplexity, and she often looked half puzzled, half anxious or distressed. She spoke of being "in a muddle," "mixed up"—"I don't seem myself, I am not at all collected"—"I don't remember anything"—"Everything is dim"—"I don't know what it is all about"—"I feel as if something were woven around me." Or, "There is something in my life that is interwoven."

A very prominent feature in her condition also was an expression of guilt which seems to have come chiefly in the form of accusatory hallucinations

and toward which her attitude was invariably one of protest and denial: "I thought a woman was accusing me of something I didn't do; she lies"—"I didn't do no wrong; I am innocent of what they are trying to accuse me of"—"He says guilty, guilty—I am not guilty." We shall presently see that there are essentially three types of misdeeds she is defending herself against, namely theft, hurting people, and sexual matters, but she also was at times much more general about her profession of innocence. Thus she said, "They blame me for something I never did; I never, never did anything wrong." Or again, evidently referring to the accusatory voices, she said, "I don't know what they are talking about," and at one time she expressed a vagueness directly by saying, "There is somehing I am innocent of but I don't know what it is about." For the rest she said such things as "I don't owe any bills to anybody, I thpught they said I did." Or, "Whatever I saved I saved honestly; I think they think I stole things, but I didn't; the only thing I am guilty of is petty thieving." (When questioned about the latter she explained, much more clearly than when she talked about the more indefinite matters, that when she was a salesgirl she sometimes took little remnants of silk.) Again she said, evidently referring to the matter mentioned in the history, "She gave me things but she need not say I tried to steal things; I didn't really steal things." Another set of ideas is as follows: "I never hurt anybody in my—the idea, I never harmed anyone in my life." The protests about sexual matters were as follows: "I never knew any man but my husband; I would slap any man who got fresh with me"—"I think they think—I am not bold"—"They said I had a child before I was married, but I didn't"—"I have no children; they say I have but I haven't"—"I never had anything to do with a negro; I said yesterday I got something from a negro and gave it to my husband. My God, this is not true, I never had anything from a negro"—"People think I want to break up my home." She also mentioned Chester G. several times, a man who evidently was a questionable character and whom she had known earlier in life, as she told us when she was less stirred up. It was at that time that she told us that she heard his name called in the theater. The following evidently refers to this: "They think I know something about Chester G. I never saw him since I am married," or again, "Isn't G. whom they want? He has two names." (He actually went under two names as was found out later.)

A certain feeeling of danger was also expressed at times. She asked whether she was going to be sent to the electric chair, or said, "You are going to hang me"—"The woman in there said I was going to the electric chair. Please don't write that; I have done nothing wrong"—"People want to get me out of the way"—"I am afraid you are trying to hurt me"—"What are they going to do with me here?"

It is obvious that with the pronounced tenseness which we have described it was difficult to get the patient to concentrate. Therefore, orientation questions were sometimes not answered at all. She simply went on talking in the manner described, or quite often answered that she did not know. At other times she seemed to give a little more attention and then quite often gave answers which looked as if she were disoriented. She said she did not know how she got here and later that "it was all like a trance." But in the same interview, for instance, in which she said she did not know where she was and claimed not to know what the physician was, she begged him to "do something for her head," and later also spoke of the place as a hospital, though she added that it was a queer hospital. Moreover, when her husband came, during this period in which she appeared superficially to be so confused, she

gave him a detailed account of where to find certain things in the home. Or on one occasion, when asked who the nurse and the stenographer were, she claimed not to know, but later in appealing to them called both by name. At one time when asked for her husband's address she said, "He lives with me here," and then denied knowing her own address, yet later during the same visit she gave it correctly. At the third interview with one particular physician she was asked whether she knew that the doctor had talked to her before; she said, "Yes, but it is all dim."

In addition to the traits thus far described, there are a few which in view of the further course of the psychosis should perhaps arrest our attention. Thus she said now and then, "They have taken my mind off," or, "I have been hypnotized all the time I have been here." Although similar statements might occur in certain benign psychoses, there is a certain malignant ring to them. Perhaps of some importance is also the following: On one occasion, when she spoke of being accused of having had children, and she was asked how many she was accused of having, she burst out laughing, quite in contrast to her usual mood, and said, "A small orphan asylum I guess; I guess they thought I had them like chickens." But this was the sum total of any traits that might in any way arouse one's suspicion as to a more ominous outlook at this stage of her psychosis.

At the end of the period just described, the patient, who was quieting down somewhat, said to one of the nurses, pointing to her visiting husband, "This is R. S.; you can have him," but when confronted with the statement she became again somewhat uneasy and said, "No, you can't have him, he didn't do anything, he never hurt any one, it is Chester G. you mean." Again: "There are two R. S.'s, mine never hurt any one." This statement that there were two men by her husband's name was made several times during this short transition period.

Then followed a month in which her condition varied somewhat; now she was quite clear and placid, said herself that her mind was clear, but that it had been "confused and mixed up," yet even then, when asked personal questions, she was apt to say, "I have told you all I know about myself; I am imaginative and make little out of big things" (*sic*). At other times she answered even less well; simply said, "I don't know," or replied to all questions, "I want to go home." Again, she was entirely silent and for a few days there was a marked but uneven reduction of activity, during which she sat in bed with a half-puzzled, half-absorbed expression, sometimes mumbling to herself, and resistive to any interference, even striking those about her. Now and then a direct statement of perplexity still occurred: "Sometimes I am myself, sometimes I am not." (What do you mean by that?) "I don't understand anything, I can't explain it, I want to go home." During this entire period she was at times found masturbating shamelessly.

Then followed a period of about three months, not well demarcated, during which she was fairly natural and repeatedly said that her mind was all right now, and during which for the most part all perplexity had disappeared, and only now and then short spells occurred when she said she did not know where she was. Yet even then some ideas were produced, associated with hallucinations, which showed that the vague feeling was still present, that somehow some one wished to implicate her in some way: "Do you know anything about my case outside; could they hold me for things I don't know anything about?"—"They are trying somehow to connect me; why do they say pictures? I never gave my picture to any man; they say it was found somewhere." Or, "Lots of people's names are mentioned whom I worked for;

they are trying to connect me with things I know nothing about." Or, "Mr. B. once gave Mrs. D. an awful beating. Mrs. D. saved the bloody clothes and showed them to me. Now I think these clothes have been found, but I wasn't a witness." Similar ideas were also spoken of in a more retrospective manner: "Mrs. D. and Mr. B. used to go out together and register as S. (the patient's name). I think they were trying to hurt me for years."—"I thought Mr. B. wanted to get me out of the way so there would be no divorce; then he would not be corespondent in the divorce case. I thought there was a divorce case going on in the South. There they do not take a negro's word, do they?' (Why divorce?) "Somebody said Mrs. D. was going to have a divorce and I did not want to be brought into it." (Why negro?) "Only a negro and I knew anything that would get him a divorce." And finally she said: "When I came here a woman said, 'You look as if you had a child,'" or, "Outside they said my little brother (14 years of age) was my child," and "When I came here a woman whispered into my ear, 'He is your little boy.'"

It was during this period also that she gave, at various occasions, fragments of a retrospective account regarding the onset of her psychosis and the pronounced stage of it; that is, the first six weeks after her arrival here. The main facts of this are as follows: She claimed that when she was told that she was suspected of having taken the towels she went to Mrs. M. and told her she had not taken them. Mrs. M. said she had not been suspected; "Then I got depressed without knowing why."

Then she spoke of her experience at the theater. While there, she claims, she thought there was a "concocted scheme"—"I think now it was a scheme to break up my home"—"I only heard a certain voice; it was Mrs. D.; she had a terrible nerve to get up and condemn me. I got an awful blow; it was the last place I expected it, at the theater." This woman, she claimed, also mentioned the name of Chester G. and said he was wanted for a crime. On another occasion she said that at the theater some one was wanted for murder, "I wanted to yell—afterward they spoke my name, 'Elizabeth S. $50,'" or "Later she mentioned my name, then a crash came," or "My whole system went crash"—"and I got a heavy feeling, I felt I was going to faint." Again she spoke of having gone to a moving picture show (not clear whether this is the same as the theater but it probably is). Then "Something came over my whole system; my lips, my arms, eyes, everything; my whole body; I walked out as if I were in a trance, all in a quiver; I thought they wanted to use some influence over me; they wanted to break up my home," or "Some hypnotism was put over me; Mrs. D. and Mr. B. did it."

Then she also said that while still at home she heard her name called; that it sounded like some one in distress, "like my uncle," and that he said, "remember." At the general hospital they said she was wanted for murder. She evidently remembered clearly what happened both at the general hospital and at the observation pavilion, yet stated that the first part of her stay here seemed hazy.

For the following nine months during which she was still under our observation, the patient was again somewhat different, though again the transition was by no means a sharp one. In the first place, she was out of contact with her environment more than before and often sat in self-absorption somewhat slovenly in her appearance unless the nurses attended to her, and for a time at least wet the bed quite frequently. Sometimes throughout the period she suddenly attacked the nurses. Some of these attacks were plainly associated with hallucinations—thus she said that they made remarks about her, or "They

need not bring the whole family into it." At other times she had crying spells; again laughed boisterously.

The ideas giving expression to her feeling that there was an attempt to implicate her somehow were now almost absent, though now and then a statement such as, "It seems they want to get rid of me," or "Nonsensical people are writing about the electric chair," showed that there was still occasionally a feeling that there was something going on against her, which was similar to what we have seen before; or she spoke of having been "niggered" here; or complained of the harsh treatment that she had been subjected to. Such statements were usually associated with crying. On the other hand, as has been stated, she also quite often laughed boisterously. When asked what she laughed about she was sometimes unable to tell, but once she said, "I think of funny things." (Tell us about them.) "Well, for example, I see a paper and it says, Hoch der Kaiser—but I don't like Germans; suppose some one does a mean trick and you say Hoch der Kaiser to get back at them." Or she spoke of other hallucinations which were also more incomprehensible than her former ones, "Some one said pails of jelly, seventeen cents—my father paid for them," or, "Some one said foundling; I didn't come from foundlings." Once she said: "Mrs. D. is the whole shooting match here; they want to get something on me here; they will never get any immorality on me." But as a rule her former denials were no longer in evidence, Sexual hallucinations were evidently also quite prominent: "They talk a lot of smut; they ought to wash their mouths out"—"I know why I am kept here, for the filth of social aristocracy." (What do you mean?) "Does not socialism mean free love?" She also claimed that her husband was talking "smut" at her. Her attitude toward her husband settled down to an admitted indifference and dislike. "We never were made for each other; there was a lack of understanding between us; I never dreamt it was so terrible."

Of some interest is the fact that at one time she evidently mixed up the incidents connected with Mrs. D. and those connected with Mrs. M. by saying, in speaking of Mrs. D., "She gave me some towels and said she paid for them" (Mrs. D. had given her silver and she was accused of stealing towels from Mrs. M.).

It should be added that fainting spells occurred at no time while she was under our observation.

In May, 1916, the patient was transferred to the general wards of the Manhattan State Hospital, where she remained for another year. The report from there states that while at times she was occupied somewhat, she was for the most part without much initiative and appeared self-absorbed. Till the end she was by no means free and natural. Sometimes for the first six months she had spells of screaming and irritability in which she suddenly attacked those about her. These gradually disappeared. Occasionally she made statements which still resembled her old ideas—"Something is going on but I don't know what it is," or, "They confine all people to one person." And when she was finally discharged June 4, 1917, it was demonstrated that she had no insight whatever into the morbid nature of the state she had gone through or of the ideas she had held, nor had she any desire to join her husband. She was taken to the house of her sister in another state.

Case 6.—Elizabeth H., aged 20, single, was admitted to Psychiatric Institute March 7, 1904.

Family History.—The father is living and well. A paternal aunt was insane. The mother died in her ninth confinement. The patient has eight brothers and

sisters: one dead, the rest living, patient being the eighth. They are said to be well, with the exception of a sister who had nervous spells with "crying and fainting," which ceased with marriage.

Personal History.—The patient was 2½ years old when her mother died. At first she was taken care of by an aunt, then sent to an orphan asylum, and from her fourth year she was brought up by her stepmother, who treated her badly, so that she always desired to get away from home. Yet she was of a jolly disposition, liked company, "was always with the crowd," and worked rapidly.

When 5 years old she fell on her head, was unconscious for some hours, but recovered without sequelae. When 16 she was married and is said to have been happy.

When 17 (May, 1901) she had her first child. Two days after childbirth the sister who was taking care of her accidently broke a bottle of medicine. The patient got inordinately irritated at this. Then she also got irritated at the sister because the latter used to leave her alone to talk with a neighbor (a rather giddy woman, as the patient said). Five days after childbirth she began to feel blue and her milk stopped flowing. On the tenth day she tried to get up but felt too weak. She was feverish, sleepy. At the same time she was annoyed when the baby cried. The baby was taken away. About the sixteenth day, according to the patient's own statement, she got up but felt lightheaded, had no energy, had a "silly" feeling; "I got to laughing and could not stop." She complained of noises in the head but not of voices. Her people say she seemed to take no interest in anything, laughed in a silly manner, had a far away look, and a voracious appetite. Five weeks after childbirth an operation for laceration of the cervix was performed at a hospital. When she returned from the hospital she was quite natural. After this the only difference was that she would no longer associate with the woman to whom the sister had talked, because she felt this woman had made her sister neglect her.

When 19 (July, 1903) she had a miscarriage. For a week she felt weak. About this time the sister-in-law's baby died and she was anxious for a time about her own child.

Present Attack.—She had an influenza about three months before admission (in bed a day, feverish, coughing, sneezing). For two weeks she felt rather downhearted and unable to do her work.

Two months before admission, while at her stepmother's house, she and the latter had a quarrel. The stepmother scolded her, accused her of having stolen some things from the house, and threatened to have her arrested. It is said that the patient turned white on this occasion, seemed much affected and slept badly that night. She became abnormal at once, seemed dazed, let the food burn on the stove, wept much, complained of a full feeling in the head, felt dull, drowsy, could not work. Retrospectively the patient said she felt her memory was going, that she could not think well: "I had to force myself to speak." She also claimed that for three days she did not speak at all. At night she imagined that the stepmother was haunting her. Then she began to say that some things in her house were not her own. She explained later that this was because she thought her husband had given these things away and that this was connected in her mind with the fact that at one time her sister had jokingly said that the patient on her death should leave her watch and chain to her. She began to say that she was bad, and expressed

the idea that she should not have been married, and again that they were pouring kerosene over the child.

Two weeks before admission she was taken to her sister's home. There she is said to have been quiet, motionless in bed, with a dull expression, pale. Yet she spoke at times, then chiefly about having stolen, and she seemed afraid of being arrested; when she heard wagons outside she thought the patrol wagon was coming for her. She had attacks of throbbing in the head, palpitation, numbness and stiffness in the body and limbs. These would last for an hour or so. She claimed these attacks were due to electricity, ether, or opium, and that she was being poisoned. Again, she spoke of having lice, and said bugs were in the bed. She heard voices, singing "Nearer my God to Thee," saw angels on the wall, smelled bad odors. Toward the end she refused food.

At the observation pavilion she is described as being rigid and resistive, again passive. She thought she was in a church; was getting the communion.

Under Observation.—On admission the patient looked pale (hemoglobin, 70 per cent.), had a coated tongue, dry lips, a temperature of 99.8 (this did not persist). She appeared dull, was resistive, gazed about fixedly and in a perplexed manner, half dazed, half uneasy.

For about two weeks she was kept in bed. During this time she was often quiet, gazing about in a dull, yet at the same time perplexed, manner; for the most part there was a reduction of activity and her movements were rather slow. She was apt to resist when anything was done for her, frequently refused food and had to be spoonfed. She also held her urine and had to be catheterized. Sometimes she masturbated. The most prominent feature was the fact that when anything happened her attention seemed to be easily attracted by it, and she was apt to comment on it in a perplexed whining manner. Thus, when dishes were brought, "These ain't my dishes," or, when something was said, "I didn't say that," or "I hear boats and whistles; I never lived on the water," or, when she took hold of her hair, "Who put all that hair on me," or, when the doctor came, "I don't know you," or "That ain't mine."

She also often gave direct expression to her feeling of perplexity by saying, "I am all twisted"—"They got me twisted." Or she said she was "dizzy."

Sometimes she made depressive statements, "I am no good"—"Throw me in the river"—"I stole from everybody, I ought to have been locked up in the court house," and often she said, "I have been in a bad house"—"I ought to have been taken to the station house"—"Everybody says I steal things."

Her attention was hard to get so as to make her answer questions, because she was too easily distracted by external happenings on which she commented in the puzzled, whining manner described. Therefore questions were often not answered. For the same reason her orientation was difficult to establish. Yet on the second day it was found that she knew where she had come from, how long she had been in the hospital, also that it was a hospital, though she was puzzled about this as well, as was shown by her statement, "I don't know where I am; it looks like a hospital." The month she gave as June (March) but knew the year correctly. On another occasion she called the place "the Holy Catholic Church;" again "the Varnish Works." But this varied, and more often she was found to be quite well oriented. When asked where she lived, she gave the street and number of her father's home, claimed she did not know where her husband lived, and could not be made to give her married name. (Are you married?) "I thought I was married, but I was not married; I found out afterward it wasn't his name." (No foundation.) When on one

occasion she was made to write her married name, she did so but kept repeating "That ain't my name." When an attempt was made to make her calculate, she seemed unable to do anything but simple sums, and said, "I can't do it." But she gave some old events of her life quite well, with the time of their occurrence.

After two weeks she was allowed out of bed. She stood about or walked around slowly. The condition did not change much; the prevailing mood remained one of whining perplexity, but her utterances became more frequent, at any rate when one spoke to her, and were somewhat different, as will be seen. On the other hand, she sometimes smiled readily at funny incidents or at her own absurd remarks, or she smiled when the doctor smiled. It also became evident that hallucinations were more prominent. The following are representative utterances:

"They say I catterize people here, that I give them all kinds of medicine. They say I am so swell that I spoil all the clothing in here, I ought not to be here, I can't afford to pay the money—that I do everything, that I spoil the holy wash—they bring dishes up here and everything—I don't know who owns this house." Again: "They say the men in here are bad, the priests and all; I don't know whose chairs these are, I never said anybody was bad —They say I owe everybody so much money for clothes, I never took any money, I never led any girl astray, if they go it is none of my business"— "I never gave anybody any medicine, the nurses give a lot of medicine—I never talked French" (another patient had said something about speaking French)— "They say I live on $100 a day, I haven't got no money"—"All the wrappers they brought up today"—"They made them take off their clothes" (at the bath)—"They say I created the earth, that I have a yacht—I don't." When something was said about graham bread, "Mr. Graham is not my brother." When a nurse swept the floor, "I did not make that dirt"—"They say I am a dog"—"They say I eat rats but I don't"—"They say this is a whorehouse, everybody dirty, rotten people and Coxey's Army." Again: "They say I stole everything—this is no whorehouse"—"They killed geese in here and I ate them" —"They say I own this house."

The condition gradually improved. Toward the end of it she wrote a letter to her brother saying she felt better; that she had been insane; that her husband had sent her to Bellevue Hospital, and that she felt in everybody's way. She signed this, "Your loving wife."

By the end of May she became freer and somewhat elated, a little overactive, a little talkative, somewhat forward, but without flight of ideas. She admitted herself that she was overtalkative. This lasted only two or three weeks. Then she got perfectly well, with good insight. She was discharged June 27, 1904.

Retrospectively: It was demonstrated that she recalled well all the incidents connected with her entrance to the hospital and many incidents later, but she claimed that at first she thought she was in New Jersey or that she was in a church, and she claimed she was not clear where she was for two weeks. As to how she felt during that time, she said she felt dizzy, her hands felt numb, her skin tough, her blood did not seem to circulate; all days seemed alike; it was as if the end of the world had come. Her thoughts wandered; the questions dumbfounded her; she felt mixed up.

A prominent idea throughout was that she had stolen and was to be arrested. She had a feeling that everything referred to her. When people turned around she sometimes thought it meant she had to change her religion. Nobody but

very rich people seemed to be about her, and she thought she had to bear all the expense. She was afraid to sit down, because she thought she would have to pay if she did. Voices were prominent. She was called bad names. They came out of the register; once she thought she saw her husband and child outside.

CASE 7.—Ida N., aged 34, married, was admitted to Psychiatric Institute Jan. 25, 1905.

Family History.—The patient's father was drowned. Otherwise nothing is known about the family history.

Personal History.—When about 15 the patient had some sort of "nervous fever," during which her hair came out. It is thought that since then some traits which are said to be characteristic of her, namely, that she was nervous and easily startled, had become more marked. When 19 she came to this country and worked as a servant girl.

Soon after coming to this country she began to go with her later husband, and after a year had a baby which died in six months. When she was 22 she began to live with him and then had a second child (living at time of second attack). The husband states that she was a good housewife, a conscientious mother, and a sociable neighbor.

First Attack.—At the age of 27, in 1898, she had a former attack and was treated at the Manhattan State Hospital. From the notes made at that time and from the account which the husband gave at the second admission, we gather the following: It came on in the early part of her third pregnancy (after recovery from her second attack the patient said it was caused by the worry about her irregular position). She began to complain of hoarseness, pain and choking in the chest. Two days before admission to the observation pavilion she seems to have become definitely abnormal. She got uneasy, said the neighbors were down on her, had been talking about her and wanted to harm her. She became quite upset, wrung her hands a good deal, insisted she had done nothing, wanted to see all sorts of neighbors. The following night she became quite excited, jumped around and sang, but it is claimed without appearing happy.

At the observation pavilion she is described as uneasy, biting her lips, saying something was going to happen and that the people were talking about it.

At the Manhattan State Hospital, where she was sent after a few days' residence at the observation pavilion, her psychosis lasted two weeks. She is described as agitated, walking up and down, distressed, swaying back and forth, pulling at other patients, affirming she had done nothing. When questioned, she often said, "I don't know." The notes also state that she spoke of her husband having left her (not true).

Then she got perfectly well, active, natural, helped on the ward.

After she was discharged her husband married her and she remained well. She had her third child without any upset and later a fourth.

Present Attack.—Two months before admission she heard of some gossip about her past which actually had been going around. The husband said she worried a good deal about this but was not decidedly abnormal.

Two weeks before admission she again got hoarse, complained of pain in her chest, and at about the same time a woman acquaintance, referring to the gossip, said to her, "You have awfully bad friends, but I will tell you about it when your cold is well."

Six days before admission she had a scene with the girl who was largely responsible for the gossip, but unfortunately no details are known about this conversation. Having appeared normal, or at any rate nothing more than worried, up to that time, she now became restless, began to sleep poorly, told her husband that the neighbors were down on her, were trying to harm her if they could. She kept walking up and down talking about this, yet she did not tell her husband what she was accused of but said she was blamed for giving a Catholic woman meat on Friday (the day before). (On recovery the patient stated that this woman had some meat, but that it was uncooked so that she did not know whether she ate it on that day, and that she had not given it to her.) She became restless as time went on, moaned, and finally got quite excited and shouted. At the observation pavilion she is said to have appeared depressed and dull. She kept affirming that she had not killed anybody and that something had been given her to make her sick. No mention is made of any perplexity.

Under Observation.—On the first day she looked dull, preoccupied; when questioned she was apt to repeat the question in a rather perplexed manner and often without answering, but she repeatedly spoke spontaneously; said "What about the girl?—I never see—I don't know if she did—I never have done anything to her—people here—people here." But she could not be made to tell more clearly what she meant. In spite of the difficulty in obtaining answers, it could be established that she was oriented.

Then for two weeks her condition, though similar to that of the first day, was different in so far as she appeared more perplexed and more puzzled by what she saw and heard. It may be described as follows:

She showed, above all, a marked perplexity and uneasiness. She was apt to turn to everything which happened, commenting on it in a puzzled manner, asking what things meant, such as the temperature taking, the medicine which was brought, the acts of other patients, and, for example, when the doctor's glasses fell off, she would say, "Why did they fall off?" and when he put them on, "Don't do that," or when he wrote, "Don't write," or she repeated in a perplexed manner something which she heard as if she could not grasp its significance, or when she heard a patient curse, she said, "Oh my! I never said anything like that." In fact, she often remarked in this way on every change in attitude of those about her. When asked questions or asked to do anything, there was great hesitation, though the individual motions were not made slowly, or individual sentences were spoken quickly. She was apt to repeat the question with a rising inflection but frequently without answering it. Or, for example, when asked to put out her tongue she would say, "Put it out," without trying it. (Give me your hand.) This had to be repeated often. Finally, when asked whether she could not do it, she said, "Yes, I can do that too, I can give my hand." (Don't you want to?) "Yes, I want to," but she made no attempt. (Shake hands.) "Yes, I will shake hands." Makes no attempt. Finally, on repeated urging, does it slowly, again interrupts it. As the doctor goes, she put out her hand. In eating she also made many hesitating, unfinished movements without accomplishing anything. Frequently she said, "I want to talk to you," but produced nothing, yet when the physician turned to go, she would say, "No, stay," or she would say, "Yes, I will tell you, sit down, don't write—don't do that (as he turns over the pencil)—I will tell you—I ain't done nothing—don't look at the time," as doctor glances at the clock, etc. The statement "I haven't done nothing" was extremely frequent and quite often she added "I haven't done anything to that girl." Or

she said, less frequently, "Let me live a little longer," "You will save me," or "You wont lock me up."

Usually the things which happened about her merely called forth the statements of perplexity or appeals to stop it or affirmations that she had nothing to do with it. She never elaborated her perplexity or uneasiness into any definite delusions of apprehension or reference, with the exception of the fact that she said a few times, "They are all laughing at me."

The orientation was often not easy to settle, on account of her difficulty in giving complete answers, but with persistence it could be established that she was pretty clear about the time and the fact that she was in a hospital. There was no definite evidence of hallucinations.

Feb. 8, 1905, she began to ask for work and occupied herself somewhat, yet the other traits continued to quite an extent but diminished during the following two weeks. Then she became quite active and natural, and was discharged recovered (March 27, 1905).

Retrospectively: It was shown that she had a good recollection of the happenings at the observation pavilion and here, thus showing that there had been no essential clouding. She stated that on the boat she was frightened by seeing a girl on a stretcher. She thought the girl was drowned. She claimed it was this she referred to constantly by saying she did not kill the girl. She also said she was always frightened of the water, and mentioned in this connection that her father was drowned. As to a possible cause of her breakdown, she spoke of the fact that she was made nervous by the gossip, but even when quite well was inclined to be reticent about the details of this and only reluctantly admitted that the gossip was about her past.[1]

ANALYSIS OF CLINICAL PICTURES

These clinical pictures, though they differ among each other in certain details, have yet a good many features in common, which justify our classing them together. These we will now take up in detail.

A. Perplexity.—The first feature is the evidences of actual perplexity. The most frequent, observed in Cases 1, 2, 3, 4, 5, 6, are the direct statements that the patient is "confused," "mixed up," "muddled," "twisted," "does not understand." In such utterances it is not at once clear to what this mixed up feeling refers, that is, whether, to use Wernicke's phrase, this perplexity is autopsychic or allopsychic. The other utterances, however, show us clearly that it is chiefly a perplexity of the latter kind, with which we are here dealing. We shall have to refer to this again when we deal with the question of orientation and of the capacity for intellectual operations. For the present we will only state that we often find such statements as "I don't understand things"—"I cannot grasp things"—"I don't know what is going on"—"It is all a mystery"—"I don't

1. The fact that all the cases here reported are women need have no particular significance, since it may be due to the distribution of the clinical material at the Institute, which has purely external reasons.

know what is the matter"—"I don't know what it is all about"—"I can't tell anything about anything"—"I don't know the whole trouble." Patient 4, who had many hallucinations, said: "Everybody says something I can't understand." Patient 3 said: "I don't know what people say to me." "They are pulling me. I don't know what it means." Patient 7, though she did not give direct utterance to a feeling of perplexity, frequently asked in a puzzled manner what trivial occurrences meant, or repeated statements which she heard with a puzzled expression. Compared with these utterances, those which might denote an autopsychic perplexity are distinctly in the background. Patient 1, who, like the rest, expressed her allopsychic perplexity by saying she could not grasp things, said: "I don't feel straight" and "I don't know how I feel." Patient 5 spoke of not remembering anything, and Patient 2 spoke of her mind being weak, of not being able to remember, and asked "Am I silly or crazy?" again she said, "I don't know what to do." In this same category should also be mentioned the statement of Patient 5, who said, "There is something in my life that is interwoven." The perplexity was also shown in the facial expression in many patients. This is mentioned in the notes in five out of the seven cases, which of course need not mean that it was not also present in the two remaining ones.

We can summarize, therefore, by saying that all patients showed perplexity either in their facial expression or in certain utterances denoting a feeling of being mixed up, and that this latter referred especially to being mixed up in regard to the environment. A certain amount of autopsychic perplexity was shown, in addition to this, in some cases.

B. Orientation.—For the reason that the patients expressed so much confusion regarding the environment, it seems best to take up next the question of orientation. The striking feature here is that when orientation questions were asked the answers often made one think that the patient was seriously disoriented, as might be expected from what has just been said, yet on further examination it was often found that there was more a subjective sense of confusion than an actual persistent incapacity to elaborate the data of the environment. This conclusion was also repeatedly borne out by an examination of the patient after recovery, when it could be shown that she had a clear recollection of the events which happened during the psychosis and of their relation and significance.

The most frequent experience was that the patient said she did not know, when asked orientation questions (1, 3, 4, 5). At other times it was impossible to fix the patient's attention sufficiently so

that any answer could be got. This was especially true in Cases 6 and 7, patients who were constantly distracted by trivial happenings in the environment. There were also some more specific statements: When Patient 5 was asked where her husband lived, she said, "He lives here with me," or again, she said spontaneously, "I don't know how I got here; it is like a dream." Patient 4 also said, "I don't know where I am; I don't know how I got here." Patient 1 said that the days were mixed up, and Patient 4 that there were no days or nights. Yet on further questioning the results were different. In Case 1 it was found that in reality the patient was clear about her environment at the time as well as retrospectively after recovery. Patient 3, in spite of frequent statements that she did not understand, knew the names of the hospital and of the people about her and approximately the time of the year, while Patient 4 knew at least that she was in a hospital on an island to which she had come in a boat; also that she had been first in another ward. She knew, moreover, the date, approximately, and at one examination knew the physician was a doctor. It was also possible to show after recovery that she remembered many details, even of the early part of her stay at the hospital. A similar situation obtained in Patient 7, who knew she was in a hospital and was approximately clear as to time. Above all, we could show after recovery that she had a good recollection of the external events which happened during her psychosis. The discrepancy between subjective and fundamental confusion was well brought out in Case 5. This patient, during the same interview in which she claimed not to know where she was or who the doctor was, asked the latter a little later to do something for her head, and spoke of the place as a hospital; or when questioned about the names of two nurses, claimed not to know them, but later in the interview spontaneously called them by name. In the same way she claimed not to know her own address when asked for it, but later gave it correctly. In this connection it should also be mentioned that in the midst of this state, when she claimed to be so confused, she gave detailed directions to her husband as to where he could find certain articles in her home. In Case 6 we have evidently at times something more than merely a subjective confusion. The patient gave the date as June instead of March, and called the place the Holy Catholic Church, or again the Varnish Works, and retrospectively she claimed that she actually thought at the time she was in New Jersey or in a church. ***But even this case showed correct orientation in the midst of this period at times.*** Case 2 differs inasmuch as the patient's sense of confusion was not so much brought out when questions about orientation were asked, as

it was uttered spontaneously, so that in her case no difficulty was encountered in establishing her orientation.

These experiences may be summarized by saying that usually orientation questions brought out the statement that the patient did not know the answer, or called forth directly wrong answers, but on further examination the answers were, at any rate, much better than would have been expected from a more superficial analysis. In only one case did we find a more decided interference, inasmuch as the patient not only did not give the time even approximately and was disoriented as to place, but also said retrospectively that she had not been clear at the time. Yet even here the orientation during the same period was on other occasions correct. We can state, therefore, as we have already done, that the chief reason for the apparent disorientation is a purely subjective sense of confusion which we also found constantly expressed in the spontaneous utterances. That there may nevertheless be at times a certain if only temporary difficulty of elaboration is shown in Case 6.

C. Changes in the Sphere of Emotions, Thinking and Action.—In order to make the further description as natural as possible, it seems to us wise not to tear asunder too much the changes in the realm of the emotions, thinking and action, in spite of the fact that we have, for obvious reasons, already taken up the orientation. We know from our experiences with the essentially affective reactions, especially those purest forms which we call manic-depressive psychoses, that we are apt to find closely related alterations in these three fields.

The affective changes were quite marked. Our cases invariably showed, in addition to the perplexity, a pronounced uneasiness or distress. In five out of the seven cases this uneasiness was associated with a decided restlessness, whereas in the two others more with phenomena of inhibition. Patient 1 showed restlessness in constantly moving her hands—pulling at her clothes, brushing herself, or making meaningless motions with her hands. On the other hand, she was very slow in answering questions which referred to her worry, but this was out of proportion to any general slowing of answering, though she calculated slowly but correctly. In Case 2 the notes merely state that the patient is mildly but constantly restless. In this case there was a marked difficulty in thinking when any concentration was required. Patient 3, whose psychosis lasted much longer than that of the others, had but little restlessness. She sat about or often walked about slowly, but she had periods when she became stirred up and was then more restless. She was very uneducated and probably slightly defective intellectually, and no special

effort was made in this period to study her capacity for thinking. Patient 4 was often very restless and at times quite talkative. Here the train of thought showed interesting changes. The sentences were poorly arranged and appeared disconnected, yet they were nevertheless held together, as it were, by the fact that the entire talk was dominated by an affect of distress which imparted to it a complaining tendency. Patient 5 showed a more or less pronounced restlessness which manifested itself at times merely in a certain tenseness, again in twisting her fingers, pulling at her hair, walking up and down, biting her fingers, etc., and not infrequently in a certain uneasy talkativeness. This patient, too, showed changes in her train of thought similar to Patient 4, as here again there was a poor arrangement of sentences, many of which remained unfinished, while there were also many repetitions. It was as if she kept interrupting herself, then took up the thread at a different place, while she also had a constant tendency to repeat herself. But here again the whole train of thought was held together by the feeling of distress and the fact that the talk was concerned essentially with one topic, namely, her protestation of her innocence. Of interest in this connection is the fact that, when the patient gave an account of some matters in her earlier life on one occasion, instead of talking of her immediate feelings as usually, the train of thought became much more connected. Of course it was under the circumstances impossible in both of these cases to make them concentrate on any tests. In this connection we should also mention the remarkable excitement by which the perplexity in Case 3 was ushered in. The patient suddenly began to show a pronounced motor restlessness with marked distress associated with many apparently purposeless shaking and rubbing motions, while at the same time she kept repeating: "I don't know what is the matter"—"I don't understand anything"—"I don't know the whole trouble." Finally this motor excitement rose to throwing herself about in bed and against other beds, while she kept shouting "police." This was followed by a state of exhaustion and then by the perplexity reaction already described.

As has been said, the last two cases differed. Patient 6 was often quiet and there was a distinct reduction of activity, with rather slow motions. With this there was associated a tendency to resistance when anything was done for her, frequent refusal of food, which necessitated spoonfeeding, and holding of urine so that she had to be catheterized. Her attention was difficult to get, and she could not be made to calculate anything but simple sums, saying, "I can't do it," yet now and then she gave some data of her life quite correctly, even with the time of their occurrence. Patient 7 showed, above all, a great hesitation when questions were asked, although

individual motions were not made slowly and individual sentences were spoken quickly. This hesitation showed itself in answers and in executing commands. She was apt to repeat the question or the command without being able to answer or to carry out what was asked of her. Frequently she interrupted her half-finished movements by counter-impulses, so that there seemed to be a constant interplay between agonistic and antagonistic impulses. In the same way she would frequently call the doctor back, when he was about to leave, with the statement that she wanted to say something, but without being able to bring herself to say anything. Under these circumstances few questions were really answered.

If we try to summarize and interpret what we have found in the realm of emotions, thinking and action, we must state in the first place that all cases show marked distress which in four of them was associated with marked restlessness; in one, a case of much longer duration, with episodes of restlessness only; whereas in the two others inhibitory phenomena dominated the situation. In the first group we find two cases in which there was a decided difficulty in thinking with moderate restlessness, and in one of these besides, a slowness in response. But the slowness of response in this case was limited to the answering of questions referring to her worry and probably finds its explanation in the fact that this worry was not formulated. We shall presently see that this is an important integral feature of the perplexity reaction. It may be well to remark here that we find cases of manic-depressive depression at times in which the patients show not only a moderate retardation, but occasionally an additional hesitancy when their feelings are inquired into. In contradistinction to what is commonly found, this makes the retardation very uneven. It is not impossible that in such instances we are dealing with an addition of perplexity features superimposed on the simple depression. The thinking disorder which showed in slow calculation or in a general difficulty in accomplishing intellectual tasks in which concentration was required, may be fundamentally similar to the well known thinking disorder of manic-depressive insanity.

Special reference should be made to the interesting disturbance of the train of thought which we find in the two cases in which, in addition to the distress and restlessness, there was present a marked talkativeness. We are well aware that in states with pronounced affective changes we are apt to have certain characteristic abnormalities in the train of thought. We only have to remember what we find in manic states and in certain conditions with marked anxiety and restlessness. If, therefore, we have here a peculiar train of thought, in some instances, which consists in a poor arrangement of sentences, a stopping in the middle, a picking up of the theme at

another place, and a tendency to repetition, we must admit that this is a disorder which is psychologically not unexpected on the basis of the entire perplexity reaction, and we must regard it, therefore, as an integral part of some phases of this reaction.

We have to dwell a little more at length on the inhibitory phenomena which occurred in Cases 6 and 7. In Case 6 the general reduction of activity and the slowness of motion was again not unlike the retardation of manic-depressive depression, and the distinct difficulty in thinking may be fundamentally also akin to this. But in addition to this there were also present certain negativistic traits (resistance, refusal of food, retention of urine). Unlike the typical catatonic negativism, these phenomena in our cases existed, however, in a setting of distress. Now we know that in anxious states we not infrequently find a marked resistance—the patient wards off all interference with a definite idea that there is danger and that something terrible might happen to him. In our cases, however, we can hardly assume that the distress led to anything like the clearly elaborated ideas which we find in these anxiety states. Certainly the holding of urine cannot be thus interpreted, especially not in the absence of any delusions about it, and the same may be said about the refusal of food. But it must not be thought, it seems to us, that such a symptom as catatonic negativism is necessarily fundamentally different from resistance with a good cause. The essential of all these reactions is probably an attitude of opposition as a protective mechanism. That in dementia praecox there exists a negativism which is utterly independent of any affect or logical idea is due to the fact that here automatic mechanisms come into play on account of the fundamental disorder of this disease, which unfortunately has not yet been clearly grasped by anybody, but which Kraepelin has called a disorder of the will. From that point of view we can well understand that in various psychopathic reactions there may be transitions from the more elementary and utterly incomprehensible negativism to one which is logically determined. This excursion was necessary in order to show how in our opinion the reactions in Case 6, which impress us partly as purely negativistic, partly as arising on an affective basis, should be regarded.

Interesting is the situation in Case 7 in which we find many peculiar inhibitory phenomena not unlike so-called catatonic symptoms, namely, the constant interruption of acts and the peculiar interplay between agonistic and antagonistic impulses. It is perhaps less remarkable that these phenomena are present in this case than it is surprising that they are not present in more of them, for they certainly do make the impression of a perplexity in action. We are here reminded

of a statement by Bonhoeffer[2] that in catatonia the alternation of negativistic and agonistic impulses produces a typical perplexity. With this interpretation in mind we naturally ask whether in our case this frequent change in the direction of the impulses does not, in part at any rate, produce the perplexity. Although we have not at hand any observations of real dementia praecox cases in which the phenomenon was present, and have for that reason perhaps no right to pass judgment on an explanation which refers specifically to those, we are inclined to think that Bonhoeffer's explanation is based on the general tendency of the Wernicke school to regard "catatonic" phenomena in the light almost of focal, or at any rate, fundamental, symptoms which give rise secondarily to other manifestations. This, however, is, after all, still a hypothesis, and to our mind it is rather unlikely that it has any wide application. Certainly, in our case, it would seem forced to accept such an explanation, considering the fact that in the material here presented perplexity is present so often without those "catatonic" phenomena. On the other hand, the assumption given in the foregoing that for some reason or other this frequent change in the direction of the impulse is a partial manifestation of the entire perplexity reaction, is more probable, although we frankly admit that we do not know why it should be present in only one of our cases.

D. Content of the Psychosis.—We next come to the content of the psychosis in these cases. In discussing this we will start with Case 4. This patient hallucinated freely. The hallucinations were almost invariably accusations of various misdeeds. She was called a thief, a crook; there had been a fire, a whole crowd got burned, dead people were taken out and she was blamed for it. Then again she was called a whore, accused of relations with men. Everybody was chasing her, suing her, the whole crowd was putting the blame on her. But these accusations were not accepted by the patient; they had no counterpart in anything like self-accusations; on the contrary, she constantly protested against them. In regard to the fire she said "They can't blame it on me." About the sexual accusations: "I am respectable"—"Why should I go and be bad"—"I have to be bad and it is not my nature"—"My heart and soul says I am married—so many people for one person." That the last has a sexual meaning is shown by the statement "But they ain't my husband." There are some other statements which are not clear in their significance, but it is evident that the main part of the content is contained in what is given above. We should add only that to the

2. Bonhoeffer: Die Psychosen im Gefolge von akuten Infectionen, Allgemeinerkrankungen und inneren Erkrankungen. In Aschaffenburg's Handbuch d. Psychiatrie, Special Part, Section 3, First half, p. 70.

patient these hallucinations evidently gave a sense of great multiplicity, as she said, "Everybody says something different." The essential in this seems to us to be the fact that there are numerous hallucinatory accusations against which she protests vigorously. The condition in Patient 5 was in many ways similar. She, too, had many hallucinations accusing her of misdeeds and against which she constantly protested: "Whatever I saved, I saved honestly—they think I stole things but I didn't," or "I never hurt anybody, never harmed any one in my life." Or in the sexual sphere: "I never knew any man but my husband," or "They said I had a child before marriage, but I didn't"—"I never had anything to do with a negro," etc. She also said, "I am innocent of what they are trying to accuse me of." Here a new element may enter. While in the utterances just cited the patient was clear of what she was accused but denied it, it is here possible that she may not even be clear about what the accusations are. That this is at times definitely the case in this patient is shown in the following utterance: "There is something I am innocent of but I don't know what it is." Into the same class of phenomena probably belongs her statement, made at times, that she did not know what the voices were talking about. Therefore, here again we find, essentially, hallucinatory accusations and vigorous protests against these accusations, together with evidence that here and there the accusations are not formulated.

A transition to the next group is Case 2, which presents a phenomenon similar to the preceding two cases when the patient said, "What do they mean by saying I stole?" Here we have at any rate a lack of acceptance of the accusations. She also showed a feature which is similar to that which we find in depression, that is, she felt she was wicked and asked, "Have I done wrong?" But here the striking fact is that she was unable to say in what her wickedness consisted. There were, therefore, accusatory hallucinations which were not accepted, or when there were no hallucinations she had a feeling of wickedness, but this was not formulated or focussed. This is a similar principle, therefore, to that which we have found indicated in Case 5. We find it again in a marked form in Cases 1 and 3. Patient 1, in the beginning of our observation, had a few well-formulated ideas of self-accusation. She thought she had had a miscarriage (unmarried) and was guilty of theft. This soon receded into the background, however, and the prominent feature of the content was henceforth that she was unable to say about what she worried and fretted. She claimed it was too vague, too hazy. That this was not merely a desire on her part to hide her ideas is shown by the fact that, after recovery, when she cooperated very well, she again stated that she really had not known at the time and did not

know now about what she had worried. In other words, after a few ideas of guilt elaborated as self-accusation in the first days, we find essentially a complete lack of formulation or focussing of any content associated with her distress. Something similar is found in Case 3. Before her state of perplexity the patient had gone through a condition characterized by anxiety, with ideas of self-accusation, plainly accepted accusatory hallucinations, and other depressive ideas. All these ideas referred essentially to the poor care she had given to her children or to the fact that her children or her husband had been killed. During the state of perplexity the patient was, for the most part, no longer able to state about what she worried, although an occasional repetition of her ideas of the first period was noted, when she said she was bad and had not taken care of her chidren, or she spoke of her children having been taken away. Therefore, here again is a shifting from what in a preceding state of anxiety had been clearly formulated ideas to an incapacity to state, for the most part, about what she was fretting in the state of perplexity.

Very different, however, are the last two cases, although Case 7 presents some features which at once show a relationship to the patients who constantly protested against accusations. A very frequent utterance of hers was, "I ain't done nothing," or "I ain't done anything to that girl" (a girl she saw on a stretcher while she was brought to Ward's Island on the hospital boat, and who, she thought, had been drowned). We have no evidence here of any accusatory hallucinations, but only indications of an indefinite feeling of being accused. Against this she protested. But the most prominent feature in this case was her frequent denial that she had anything to do with a lot of trivial incidents which happened about her, and which she felt had, somehow, something to do with her. There was also a constant desire to stop these occurrences. There was, therefore, a marked feeling of being responsible for many external happenings, which responsibility she, however, denied by saying she had nothing to do with them, while she also tried to stop them.

Patient 6 had, like a case of depression, some well-formulated ideas of guilt, partly in the form of self-accusation, partly in the form of accusatory hallucinations: "I stole from everybody"—"I have been in a bad house"—"Everybody says I steal things," or "I ought to be locked up in the Court House"—"I am no good, throw me in the river," and even after recovery the patient admitted having had ideas that she had stolen. But these phenomena were distinctly in the background, while in the foreground of the clinical picture, as in Case 7, stood a pronounced feeling of reference in regard to a great many trivial incidents and constant denials that she had

anything to do with them. Thus, when dishes were brought in, she said, "These ain't my dishes"; when something was said, "I didn't say that," or "I hear boats and whistles; I never lived on the water," or about something else, "That ain't mine," etc. Therefore, here again was a feeling of being responsible for external happenings and a denial of this responsibility.

In an attempt to see what is common to all these different types of content, we find that running through everything (where there is a definite content) is a depressive coloring. It is, moreover, much as in depressive states, in the nature of guilt. In the first place, we have repeatedly seen definite self-accusation which does not differ from that of depressive states, but which is always in the background in these perplexity reactions. But then we find what we might regard as a projected self-accusation either in the form of a feeling of being accused (Case 7 in regard to the death of the girl) or in the form of accusatory hallucinations (Cases 4 and 5). In all these instances, however, this accusation is not accepted, but violently protested against. Another form of projection consists of the peculiar ideas of reference which we find so prominent in Cases 6 and 7. Here the patient neither accuses herself nor do voices accuse her of anything specifically, but she feels guilty about a lot of trivial happenings in her environment; again, however, denying any responsibility in regard to them or trying to stop their happening. Next we find in Case 2 an example of the patient feeling wicked without being able to tell in what way she feels wicked, and in Case 5 its more projected counterpart of the patient feeling accused without being able to say of what she is accused. It seems to us that this leads over to the cases who were quite unable to say what they were fretting about. It is interesting that in Case 1, in which this was so pronounced, there was at first an expression of definite ideas of self-accusation which then vanished, and at the height of the perplexity the patient no longer could formulate what she worried about. In view of the general trend of these cases it hardly seems an unwarranted conclusion to say that the patient could not formulate her guilt. The same situation evidently existed in Case 3.

We seem justified in stating, therefore, that whereas in the depressive reactions there is frequently a feeling of guilt formulated in definite ideas of self-accusation, there is present in these perplexity reactions also a feeling of guilt, but it is dealt with in a very different manner, not to be sure uniformly, but in various ways which, however, all come to about the same thing. They are as follows: 1. The patient cannot formulate her feeling of guilt. 2. There is a projection of the feeling of guilt which finds expression in accusatory hallucinations which are not accepted or which are pro-

tested against. 3. The feeling of guilt may be projected and give rise to a marked feeling of reference in regard to many trivial acts. But here again the patient denies all connection with them or tries to stop them, or, in other words, does not accept them. It appears, therefore, that there is either no formulation, or when there is a formulation it occurs in the form of a projection and is not accepted. *Not formulated or not accepted guilt seems, therefore, to be the fundamental characteristic of the content of these perplexity states.*[3]

Now in our opinion it would be quite wrong to say that the content is the result of the perplexity, in the sense, for example, that since there is a certain disorder in thinking, anything like a clean-cut formulation of the content is impossible, even if we accepted such a possibility *a priori*. The very fact that in our cases the same result is reached in different ways speaks against such an assumption. It would, of course, be equally wrong to say that the perplexity arises because the content is not formulated or accepted. The same problem has repeatedly been discussed in melancholia, where the question was asked whether the patient was melancholy because he had depressive ideas, or whether he had depressive ideas because he was melancholy. The most reasonable attitude in all these questions seems to be to regard these various forms of mental reactions as units with a more or less definite and consistent symptomatology.

Considering that the content in these seven cases is so uniform, at least when analyzed as we have just done, it is evident that it forms an integral part of these perplexity reactions.

But so far we have taken up only the salient features of the content, and it is now still our duty to collect the loose ends. We may first consider the *feeling of reference*. We have seen that Patients 6 and 7 had this symptom to a very marked degree, and we have seen how they elaborated it. The only other patient who also

3. After the article was finished we came across another case which undoubtedly belongs to this group, and the essentials of which should be added at this place because its content showed a slight variation from what has been described. The patient who had a pronounced distressed perplexity also had a decided disinclination to do anything (shake hands, go to meals, go to bed, come into the examining room, etc.), while at the same time he said, "I do not understand; everything I do makes it worse." In this case evidently the principle is not different. He felt that what he did was wrong, in other words, a feeling of guilt was attached to his own (trivial) doings. This throws some light on what we have called perplexity of action in Case 7, because in the present instance the situation is rather more transparent on account of the fact that the patient expressed a distinct feeling that his actions were wrong. To these cases who certainly showed something like negativism Bleuler's claim seems to apply, to the effect that the normal prototype of negativism is to be found in perplexity.

had a marked feeling of reference was Case 2. She claimed that every little thing had a meaning. This case, as was shown, did not elaborate this feeling in the same way as Cases 6 and 7. *Ideas of persecution* were present in two of the cases. Patient 4 spoke of many people being against her. Patient 5 said people wanted to get her out of the way; that somebody had spoken of the electric chair, or, she said, "You are going to hang me." It is natural that this symptom should exist in these two cases, because they are the ones in which accusatory hallucinations were most pronounced. Somewhat related to these ideas but fitting better into the setting of the case than would a direct feeling of persecution is the fact that Patient 7 often begged to be saved. There are a number of other ideas which are quite incomprehensible and evidently not characteristic, as they are isolated, such as the idea of Patient 1 that her eyesight would be ruined if she had a movement of the bowels, that the urine was coming from the wrong place, and the idea of Patient 2 that she had turned into two girls and had glass eyes all over. More comprehensible is the idea of Patient 6 who denied her marriage and her married name. We know from experience that this is not an idea which is in any way peculiar to these cases, but one which is very frequent in all sorts of psychotic reactions. It represents one of the fundamental and most common wish-fulfilments which arise from the fact that the adaptation to married life is inadequate.

We finally have to call attention to a set of ideas of which in the description of the cases we have spoken as belonging to the *sensory—unreality complex*. We know very little about the origin and significance of these ideas. In their most marked forms they are best known to us in anxious melancholias, more particularly those of the involution period. In a milder form they occur, for example, in more benign depressive states. Without, as we have said, knowing anything about their origin, it has always seemed to us that a certain relationship exists between: (1) The feeling that somehow the impressions of the outside world no longer call forth the same emotional response (expressed in the ideas that nothing makes the same impression as formerly, that no satisfaction is obtained from religion, that the affection for those formerly loved is lost, and the like); (2) the more marked feeling of unreality regarding the outside world and the patient's own body; (3) certain peculiar sensations; (4) certain of the so-called hypochondriacal ideas.[4] All these phenomena are not uncommon in various states of distress, and it is not surprising that we find them now and then in the cases under

4. Hoch: A review of some recent papers on the loss of the feeling of reality and kindred symptoms, Psychological Bull., July, 1905.

consideration, four of the seven cases presenting indications of them. Patient 2 said that nothing looked natural, everything looked alike. Patient 6 complained that all the days were alike, and retrospectively she said, "Everything looked alike; therefore I thought I could not see right." Patient 3 said her eyes were spoiled. All these are expressions which, as we often find, stand for the impression of unnaturalness which the outside world makes. Here may also belong the expression of Patient 4 that she was deaf and dumb, and her statement that her lips are dry, her blood is poisoned, that she never sneezes, never coughs, that her body is killed; very likely also the feeling of numbness of Case 6 and the idea, which undoubtedly expresses the same thing, that the blood does not circulate. Whether the ideas of Patient 4 that she is itching and has sores all over, that the womb is twisted, etc., also belong here, is hard to say. Of interest, too, in this connection is the fact that in Case 5 the perplexity commenced with such symptoms: "My whole system went crash, a heavy feeling came over my whole system"—"Something came over my whole system. My lips, my eyes, everything, my whole body. I walked as if I were in a trance, all in a quiver." This is not an infrequent beginning in cases of depression with an unreality complex.[5] It represents what Janet has called a psycholeptic crisis.

In other words, in the minor ideas of these patients we have found nothing which seems especially characteristic of our cases. Some were incomprehensible, some we found to be natural enough in the setting in which they occurred, while those belonging to what we have called the sensory-unreality complex we are perhaps not surprised to find, because they are seen in other reactions of distress.

We still have to consider the second period of Case 6, and we had best do this here under the heading of content of psychosis. The condition of this period followed the state of perplexity already discussed, and preceded a hypomanic state, the only one observed in these cases. The elated mood which dominated the latter at times broke through in the condition we are about to deal with. This was evident from the fact that, in spite of the prevailing distressed mood, the patient could be made to smile rather readily by being smiled at or by funny incidents which happened around her. Indeed, even her own absurd remarks sometimes produced this. It is interesting in this connection to note that this second period differed essentially from the preceding one in the fact that, although there were accusatory hallucinations of the type with which we have already become familiar and

5. It also occurs with sudden onset of more marked symptoms in dementia praecox, as is well known.

which she denied, many of her hallucinations had a grandiose content. These she also denied. In the first category, that is, that which corresponds to the accusatory ideas, belong such things as her protests, "I never said anybody was bad"—"I never took any money"—"I never led a girl astray"—"I never gave anybody any medicine"—"I never talked French" (when she heard French spoken)—"I did not make that dirt" (when nurse sweeps)—"This is no whorehouse"—"Mr. Graham is not my brother" (when she heard graham bread spoken of). Here, too, should be mentioned some utterances in which she did not make denials in so many words, but her whole attitude and manner of speaking them denoted that she did not accept the accusations. This was the case when she said, "They say I catterize people" and "They say I am a dog." But in strong contrast to these were the grandiose hallucinations with their protests, "They say I live on $100 a day—I have no money"—"They say I created the earth, that I have lots of money, that I have a yacht—I don't." We probably do not go far wrong if we consider this peculiar phenomenon, which occurred in a setting of an essentially "distressed perplexity" state, but in which there was also a certain undercurrent of an elated mood, analogous to the grandiose ideas which are sometimes uttered in transition stages between a depression and an elation, although it must be admitted that this does not bring us any nearer to an understanding of the condition.

CLINICAL POSITION OF THE CASES

In considering the clinical position of these cases, we must first state that we think we have plainly demonstrated by the foregoing analysis that they represent a definite reaction type. But we should nevertheless ask whether they have not some relationship with some of the larger groups of cases.

A. *The Relation of the Cases to Manic-Depressive Insanity.*—In order to make clear our attitude in regard to these classificatory questions, we would say that we do not consider manic-depressive insanity in the light of a "disease process" but as a group, most frequently of constitutional reactions in the form of affective psychoses, that is, psychoses in which most of the clinical pictures have essentially the symptomatology of the emotions.[6] Now have we any reason to regard these perplexity cases as having some relationship to these psychoses? In this connection we have to recall, first of all, that Kraepelin in his textbook speaks briefly of perplexity arising in manic-depressive

6. This does not cover all the clinical pictures, because the benign stupors also belong here, since the internal relationship with the more characterisic manic-depressive psychoses is shown partly by transition forms to them, partly by combinations with them in the same persons at different times.

depressions when the thinking disorder reaches a certain intensity. This might, of course, simplify the problem very much. It might mean that these cases are depressions with a thinking disorder sufficient to bring about a perplexity. However, to our mind it is very questionable whether an increased thinking disorder such as the one which we find in manic-depressive depression ever can produce a perplexity. It must be admitted that *a priori* it seems not improbable that an interference with the intellectual processes may produce perplexity. There naturally come to our mind the experiences in certain sensory aphasias in which we may see something like a perplexity, or some grave forms of arteriosclerotic deterioration which also present a certain perplexity at times. But that, of course, does not necessarily mean that the specific interference with the intellectual processes found in depressive states is also capable of bringing about the same result. We have seen that in our cases we are not dealing so much with an actual confusion as with a "subjective sense of confusion," and it is not likely that an increased thinking disorder would produce only a subjective sense of confusion. Above all we have shown that the perplexity reaction is one which is so characteristic in its different aspects that it seems much more natural to regard it as a unit in which the perplexity, the affect of distress, the peculiar content, all are an integral part of the whole reaction without there being any primary or secondary symptoms. For these reasons we would reject Kraepelin's hypothesis for our cases, just as we have rejected the hypothesis of Bonhoeffer. Hence it is clear that from this point of view we cannot assume any relationship with manic-depressive insanity.

But we may, perhaps, approach the problem from the point of view that the reaction of distressed perplexity is not unlike one of the emotional reactions which we see in daily life. A situation may give us joy or sadness, it may give rise to anxiety, anger, etc., but it may also perplex us. Unfortunately the symptomatology of these various normal reactions has, so far as we are aware, never been worked out, and it is difficult to say directly whether our cases would correspond to a normal perplexity, but we can assume at any rate that distressed perplexity is a normal emotional reaction. From this point of view, therefore, there is a certain justification in regarding our cases as related to manic-depressive insanity. But we have, as a matter of fact, also other evidence which speaks in favor of this assumption: (1) We have in the analysis of the clinical pictures shown certain points of relationship to manic-depressive reactions (the thinking disorder, the disorder of the train of thought). (2) Most cases are benign, that is, do not lead to deterioration. (3) We find that two and possibly three of our cases belong to manic-depressive families. This is fairly clear in Cases 1 and 2; the former patient had a sister

and a brother who each had a depression followed by recovery; the latter's father had a melancholia in advanced years, while her sister had a "nervous breakdown." Here we may perhaps also add Patient 3, whose brother had an attack of insanity from which he recovered. (4) Some of the patients had former attacks from which they recovered completely, namely, Patients 2, 6 and 7. In Case 2 we cannot tell what the attack was like; Patient 6 had an earlier attack after childbirth which began with "feeling blue"; then she complained of noises in the head, seemed to take no interest in anything and laughed in a silly manner. It is obvious that with these meager data the condition, too, is difficult to interpret retrospectively. We must admit, however, the possibility of a so-called mixed manic-depressive attack, especially since we have seen "mixed features" in the attack under observation which was, moreover, followed by a hypomanic phase. Patient 7 had an attack which in many ways (to judge from the few notes available) seems to have been like one of distressed perplexity. She was restless, distressed, affirmed that she had done nothing wrong, and in answer to questions, often said she did not know. Hence three of our patients had former attacks from which they recovered. In one of these we have not enough data to judge of the nature of the attack, in another we have some reasons to regard it as a mixed manic-depressive condition, while a third was very probably also one of perplexity. (5) More important is the fact that when Patient 1 got well she went through an unmistakable depression with the feeling of inadequacy ("I can't make up my mind to act"—"I lost my will power"), so typical of manic-depressive depressions, and a marked feeling of unreality ("Things don't seem quite real"—"affection for family diminished"—"don't feel hunger, heat or cold as I used to"), which is also not infrequent in these depressions. Moreover, this case commenced like a depression. Then again, Patient 6 had a depression before the perplexity came on, while before her recovery she went through a hypomanic state, and the second part of her perplexity phase presented, as we have seen, certain manic features. Perhaps, too, the fact is of importance that Patient 3 first went through six weeks of an essentially affective reaction. (6) Finally, we have seen that we probably have to regard the ideas of self-accusation present in some cases as representing transition features to manic-depressive depressions. We see, therefore, that a certain internal relationship of these cases to the manic-depressive group actually does exist.

Here, perhaps, is the place where Case 3 should be separately considered.

Unlike what we found in the other cases, the perplexity here lasted much longer, and after more than two years the patient has not yet recovered. It is reported that there is still a certain perplexity,

but also a good deal of inactivity without any real apathy, however. Evidently her affective reactions are still quite pronounced and are easily aroused when the topic of her children or her home is touched. Then she is apt to cry. It should be emphasized that there are no schizophrenic symptoms. In regard to the inadequacy of some of her answers, it is well to remember the remarkable difficulty which we found, especially in the anxious state of this patient, in getting correct answers regarding many data of her life and her orientation. We emphasized then her evident illiteracy and her probably low mental level. It is probable that the present difficulty may largely be due to the same factors.

The meaning of the long duration of her state is difficult to understand, but we are certainly not justified in regarding this case as belonging to the group of dementia praecox. It would seem wiser, therefore, to leave open the question whether it belongs to a larger group, and to be satisfied with what it has furnished us for the general consideration of perplexity and with the facts as they stand.

B. *The Relation to Toxic-Infectious Psychoses.*—There is unquestionably a certain looseness in the conception of the toxic-infectious psychoses. For that reason it is a great merit of Bonhoeffer[2] to have attempted to bring some order into this topic. This he has undoubtedly done, although there is still much work to be accomplished. Thus, it seems to us that not enough consideration has been given to a differentiation, from other reactions, of those types which are apt to be associated with neurologic symptoms and which have the symptomatology of the typical organic deliria. But Bonhoeffer has at least shown us certain more or less definite pictures which are apt to occur in toxic-infectious conditions. These are, among others, the Korsakoff pictures and the organic deliria. But there is also a much vaguer field of cases which are called amentia. These amentias may present typical manic features and many manifestations of "catatonia" are common in them. It is consequently not remarkable that features of perplexity should also occur at times.

We will here quote two cases which are called amentia by Bonhoeffer,[2] and which show the existence of perplexity traits, not in pure clinical pictures such as we have here described, but with sufficient clearness, we think, to enable one to recognize them as related to the reactions which we have outlined, and as will be seen, they are cases with a definite toxic etiology.

The first is his Case 17, a woman who had a fever of doubtful etiology for four days. With the fall of the fever there was sleeplessness, restlessness, speaking little, refusing food, and she spoke of wanting to kill her husband. On the fourth day after the onset she was sent to the clinic. On the way she was quite excited, beating about and spitting. Under observation she was found

weak, with little motion, and almost mute. Attempts to put her in a bath produced anxious excitement in which she appeared to be completely disoriented. She also heard accusations and kept protesting against them. The mute condition was at times interrupted by talkativeness in which she talked of family affairs and former experiences, and was distractible. Toward evening there was delirious grouping. Next day she was perplexed, surprised at everything, called the doctor and then had nothing to say. Retrospectively, she said that her anxiety began when she was transferred to the clinic, and that in the clinic she thought everything referred to her.

It is unquestionable that here certain traits, at any rate, are like the cases which we have heretofore described — notably, aside from the perplexity, the ideas of reference and the accusatory hallucinations with constant protests. If there was a complete disorientation, this, as well as the delirious groping, would denote features of another reaction.

The next is Bonhoeffer's Case 25. It is a chorea psychosis in a girl of 21, in which a state of perplexity also occurred episodically. For some months before the onset of the psychosis the patient complained of headache, sleeplessness, took everything to heart, was irritable and could not concentrate. Then she began to cry, thought others said she was not working enough, began to make incomprehensible remarks and finally had a peculiar attack with turning of the eyes, twitching of the whole body, grimacing, and foaming at the mouth. Under observation it was noted that she had a marked chorea. There were auditory hallucinations and ideas of reference. She was oriented, able to give an anamnesis, but had difficulty in concentration and made an occasional irrelevant remark. Her mood varied from euphoria to depression. At night she slept badly, saw faces on the ceiling, suddenly jumped up and called fire. With increasing chorea there was disorientation with dreamlike hallucinations for a few days. She saw heads, devils, animals, the emperor, had ideas that she had been on an express train, had fallen out of the window, had been in Berlin. With this she was distractible, talkative, flighty; a certain insight was present, and the patient herself spoke of being delirious. She complained of great heat. After six days she became very quiet; there was reduction of spontaneous activity; all answers were slow except simple ones. She now could no longer give data which she knew at first, was no longer able to read the watch, count backward, or count money. In naming objects there were some flighty replies and some totally wrong ones (nose-horse). Some apraxic reactions were present, such as straightening out of body when told to raise herself up, or straightening out of legs when told to get up. Ten days later she was mute, anxious, inaccessible, hallucinating. Later she was still monosyllabic and somewhat surly. When better she talked about dream fancies she had had, pistol shots she had heard, said she thought she had been in a cemetery. Then she developed *restlessness with numerous utterances denoting perplexity, saying she did not know what was going on, what things meant, also had a facial expression denoting perplexity, there were ideas of reference, slandering hallucinations, calling her prostitute, and the like.* This perplexity was evidently transient, but for some time after, the hallucinations and ideas of reference with good orientation continued. After this she recovered.

Here then we again have a perplexity which shows a number of characteristic features, as an episode in an otherwise different clinical picture, the whole arising on a toxic-infectious etiology.

We see, then, that features of this picture, like features, for example, of the manic and stupor reaction, may, with others, arise on a toxic-infectious etiology, but we also know that the latter two may occur in pure form on the basis of such an etiology, and it is therefore *a priori* not impossible that the same may be true for the perplexity reaction. The first diagnosis in Case 4 which was made was that of a toxic-infectious psychosis. The recent childbirth with some fever following, the tendency to subfebrile temperature, together with dry lips and coated tongue during the first part of the observation spoke for this. It was also thought that the peculiarly incoherent talk, the apparent interference with the orientation and the hallucinations pointed to it. We now know that the mental symptoms are characteristic of a distressed perplexity reaction and not of a more typical toxic-infectious psychosis, but from what has already been stated, it is by no means excluded that a toxic-infectious etiology may have had something to do with bringing about the psychosis. For a further elucidation of the clinical position of this case the condition which followed the perplexity unfortunately does not help us. She first presented for several months a peculiar, atypical, rather disgusted depression, with reduction of activity, but ability to speak promptly and with the ideas that she was disgusting, rotten inside, covered with feces; that she had no body, no eyes, no teeth, etc., a condition which was associated sometimes with a fetid diarrhea and throughout with loss of weight and physical exhaustion. Next came a condition essentially of languor. It is possible that these states, too, may have had an essentially toxic-infectious etiology. They certainly are not specially characteristic of a manic-depressive reaction, in contradistinction to some of the other cases in which we have shown that the perplexity was either preceded or followed by typical manic-depressive states.

C. *Relation to Dementia Praecox.*—We finally have to discuss the relationship of our group to that of dementia praecox. This is demanded by the fact that we consider Case 5 to be fundamentally a case of dementia praecox. We must begin by stating why in our opinion this diagnosis must be made. In the first place, the fact may be of some importance that early in childhood and again since her marriage she wet her bed and had fainting spells. This may denote a degree of lack of adaptation, especially to the marriage situation, which may tend toward a dementia praecox constitution. The perplexity state itself was in its essentials not different from that presented by the other cases. We have, however, already called attention

in the description of the case to a few features which even at that time looked somewhat ominous. Here should be mentioned her statements that her mind was taken off and that she was hypnotized. Although such utterances may occur in benign states, the feeling of passivity which they denote has a certain praecox flavor to it. The same may be said about a peculiar reaction shown in the midst of her distress when she was questioned how many children she was accused of having, and she said, with considerable laughter, "A small orphan asylum, I guess. I guess they thought I had them like chickens." Then again her shameless masturbation in the period following the perplexity was suspicious, as were also the retrospective falsifications when there was no longer any perplexity. Even more convincing than all these traits was the terminal state. She was self-absorbed and slovenly, had sudden outbursts of laughter which she motivized in a typical schizophrenic manner: "I think of funny things," and when asked to explain, "I see in the paper 'Hoch der Kaiser,' but I don't like Germans; suppose some one does a mean trick and you say 'Hoch der Kaiser' to get back at them." Again, we must mention the incomprehensible hallucinations in a setting of general apathy: "Some one said pails of jelly, seventeen cents, my father paid for them," or "Some one said foundling asylum; I did not come from foundlings." Also the sexual hallucinations in the setting in which they occurred: She claimed a lot of "smut" was talked and she added, "I am kept here for the filth of social aristocracy." (What do you mean?) "Does not socialism mean free love?" Then again we have the spells of sudden screaming and attacking others, which without obvious external reasons were found later in her psychosis, as well as the total lack of insight when she was finally discharged "without recovery," and the fact that she was not willing to go back to her husband. Perhaps one more feature should be mentioned which seems to us to be a typical schizophrenic manifestation. At one time she said to the nurse that she could have her husband, and when confronted with this she said "No, you can't have him, he never hurt any one. It is G. you mean." Again, "There are two S.'s" (the name of her husband). Especially in view of the fact that, as we found later, G. actually went under two names, this shows a peculiar identification of two persons which we have frequently met in dementia praecox and which we are inclined to regard as rather characteristically schizophrenic. We see this phenomenon even more definitely in the episode when she mixed up the identity of the woman who three years before had given her silver which did not belong to her with the woman from whom she was supposed to have stolen the towels. Speaking of Mrs. D. (the woman who had given her the silver which she claimed was hers, but which in reality she had stolen) she said, "She gave me the towels and said she paid for them." There

are, then, many points which speak for dementia praecox in this case. It is scarcely necessary to add that the fainting spells which occurred during this patient's earlier life need not raise the question of epilepsy.

But *in spite of the fact that we have to regard the case as one of dementia praecox, the perplexity reaction as such differed in no way that we could state from that of the other cases.* This is, after all, not a new experience. We know, as we have already said, that in the case of manic as well as stupor reactions which occur in this soil it may be impossible to differentiate them from the same reactions when they occur in a benign setting, although there are frequently symptoms which are characteristic enough. It is another evidence that these states of distressed perplexity represent a typical mental reaction type, and we see now that, like some other such reaction types, it may occur in various settings. We have given evidence to show a certain relationship to the so-called manic-depressive reactions; we have shown that something like it, at any rate, may arise on a toxic-infectious etiology, and we have now demonstrated that it may occur in the course of a deteriorating disorder of the type of dementia praecox.

FURTHER CONSIDERATION OF ETIOLOGY

In spite of having touched on the question of the etiology of these cases before, it is well to devote a few words to some further considerations of it. Since three patients had former attacks, this represents for them at least a certain evidence that they arise on a constitutional basis. This would also be suggested by the fact that several belonged to families in which insanity had occurred in other members, as well as by the fact that there is a certain evidence in some of the cases showing a relationship to manic-depressive insanity. We have, however, also seen that in Case 4 a toxic-infectious etiology may play a rôle, and in Case 2 it is claimed that after a fatiguing care of the husband the patient had an "influenza," and that she soon began to be sleepless, subsequent to which the psychosis commenced. Unfortunately, no details are known about this "influenza," and therefore we cannot be certain whether it was not simply the beginning of the psychosis.

In constitutional disorders it is always an interesting question to look into the precipitating mental causes, and it seems that here we have, at least in some cases, some not uninteresting facts. Case 3 had a fight with her sister-in-law a week before admission. During this the latter pulled her hair and the patient fainted. Then the sister-in-law and some other woman threatened the patient with reporting her to the board of health and the charities department for not keeping the house clean (she was janitress). They also told her she would have

to go to the state prison. This was repeated a few days later. At that time she fainted again. The perplexity did not come on at once, but was preceded by a state lasting six weeks which was characterized chiefly by anxiety.

Patient 5 was told eleven days before admission that she was suspected of having stolen towels (she was innocent). This at once upset her and in a short time was followed by a state of perplexity. It is interesting that according to the patient the later statement by the woman from whom she was supposed to have stolen the towels to the effect that she had not suspected her, made no difference; in fact, the patient said, "Then I got depressed without knowing why."

Patient 6, two months before admission, was falsely accused by her stepmother of having stolen some things from the house. It is said she turned pale. She at once became dazed, complained of feeling dull, later said she felt her memory going. She then seems to have had a depression with, for a time, reduction of activity and essentially depressive ideas, all of which lasted about two months. Then followed the perplexity.

Patient 7 was told two months before admission that there was gossip going on about her former life (having children by her later husband before marriage). She worried about this, but did not get abnormal. Six days before admission she had a scene with the girl who was chiefly responsible for the gossip. Of this, unfortunately, no details are known. She was at once abnormal and soon became perplexed.

It is, in the first place, rather striking that in four out of seven cases there should be such obvious mental precipitating causes, and in the second place, that these precipitating causes all show a certain similarity, since all of them represent accusations. We shall not try to go into any explanation of this, but merely conclude that accusations seem to be frequent as precipitating factors of these perplexity states, but that the perplexity does not always arise immediately, but may first be preceded by another form of reaction.

Prognosis.—It is of some interest that the general duration of these cases is not long. Two cases lasted ten days and two weeks, respectively; four cases lasted from six weeks to three months. In this group is included the case of dementia praecox, but of course only the phase of marked perplexity is taken into consideration. One case (3), which is somewhat difficult to interpret, lasted much longer. With the exception of this last case, therefore, there seems to be a tendency for these perplexity states to be of rather short duration. That of course the prognosis is not only influenced by such considerations, but must be guided by the facts of the entire case, is shown most prominently in Patient 5, who deteriorated as a dementia praecox.

CONCLUSIONS

We have tried to show by an analysis of seven cases of distressed perplexity that these attacks represent a *definite reaction type,* because, in spite of certain differences, the cases are remarkably uniform. This uniformity was shown in the following features:

1. They all showed perplexity in their facial expression and in their utterances. The latter denoted a feeling of being mixed up which referred essentially to being mixed up about the environment. Although orientation questions were often answered by the patient to the effect that she did not know, or by replies which seemed to denote a definite incapacity to understand the environment, it was found, on further analysis, that answers could usually be obtained which were much better than one was led to expect at first. Therefore, the trouble seemed to be more a subjective sense of confusion than an actual persistent incapacity to elaborate impressions.

2. All cases showed marked distress. In four this was associated with constant, in one with episodic, restlessness, while in two with phenomena of inhibition. Among the restless cases two patients showed a difficulty in thinking, which may be closely related to that of manic-depressive depression. In two others in whom the restlessness was associated with talkativeness, there was a striking disorder of the train of thought which consisted in poor arrangement of the sentences, unfinished sentences, the tendency to pick up the theme at a different place, and repetition. This was regarded as on a par with other disorders of the train of thought in psychoses with marked affective changes, such as those of the manic or of the anxiety states, and therefore as psychologically not unexpected on the basis of the entire distressed perplexity reaction. Among the inhibitory phenomena present we found in one of the two cases mentioned something also akin to the retardation of movements and thought found in manic-depressive depression, but it was associated with negativistic traits (resistance + refusal of food and retention of urine). The other case showed constant alternations between agonistic and antagonistic impulses which, in contradistinction to Bonhoeffer, who regarded such phenomena as the cause of perplexity, were here judged to be an integral part of the reaction without endeavoring to explain why it occurred in only one case.

3. The content of the psychosis showed, in spite of superficial dissimilarities, a remarkable uniformity. It seemed that, just as in depression, there is an underlying feeling of guilt which is, however, dealt with in a manner totally different from depression. This manner of dealing with the feeling of guilt is not uniform, but differs in different cases, though on analysis the different forms were shown to come

to the same thing. They are as follows: (1) The patient cannot formulate his guilt. (2) The feeling of guilt is projected and finds expression in accusatory hallucinations which are protested against, that is, not accepted. (3) The feeling of guilt may be projected in the sense that the patient has a feeling that many trivial acts in the environment are wrong and that he is responsible for them; he denies all connection with them or tries to stop them; hence here again no acceptance. In still another type the patient has a guilty feeling about his own acts and consequently hesitates. It appears, then, that either there is no formulation, or when there is a formulation it occurs in the form of a projection and is not accepted. Not formulated and not accepted guilt seems, therefore, to be the fundamental characteristic of these perplexity states. Other parts of the content were much less characteristic and less prominent. They were isolated or readily comprehensible through their setting. The latter was the case with some ideas of persecution in the cases with many hallucinations, and with the ideas referring to the "sensory-unreality complex," which also occurs in other reactions in which there is considerable distress; or with the hallucinations of a grandiose character (protested against by the patient as she protested against having anything to do with the trivial occurrences mentioned) which were accounted for on the ground that manic features had entered into the clinical picture at a certain point.

4. As to the clinical position of these cases, it was shown that the reaction as such has a certain relationship to the manic-depressive reactions, that features of it, and possibly the pure clinical picture, may occur on a toxic-infectious etiology, and also that in its typical form it has occurred in a case whose further course was that of dementia praecox. It was pointed out that the same is true in the case of the manic and the stupor reaction.

5. It was shown that the reaction as such seems to occur most often on a constitutional basis and that plain mental precipitating causes are found with uncommon frequency (four cases out of seven), and that those found show a certain uniformity in that they all were of the nature of accusations.

6. Finally, it was pointed out that since in six of the cases the psychosis lasted from ten days to three months, this reaction seems, as a rule, to be of shorter duration than those, for example, of the well known forms of the manic-depressive type. It was also shown, however, that a more protracted course may occur.

PERSONALITY TESTS INVOLVING THE PRINCIPLE OF MULTIPLE CHOICE

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On the capacity to choose between competing stimuli, ideas and purposes rests the fate of the personality. Throughout life the choice lies not between absurdity and truth, reality and unreality, but between the various degrees of better and worse, between ideas or purposes which may be said to represent different points of view, different attitudes, rather than any more fundamental difference.

Despite this fact, in the tests used in psychology and psychiatry, the question of choice, as between different phases of reality, is not studied. The Binet tests, which measure intellect, usually deal with simple problems to which only one correct answer can be made. In this respect they resemble the ordinary examination paper, and have for their paradigm the mathematical answer in which choice, at least in elementary mathematics, does not enter. Most of the situations in life, as has been stated before, in which personality and character appear in evidence, are solved in a manner roughly to be compared to situations involving beauty, that is to say, the answer is often a matter of taste, many choices are possible, and therefore many answers. What comes to the front are attitudes, personality trends, decision and reasons for decision.

In order to reach toward the factors of choice I have devised the method which I call the "Method of Multiple Choice." Incomplete situations are presented to the subject, and he is given his choice of certain completions, any one of which represents a point of view, an attitude of the personality, perhaps only an opinion. Whether one or the other of these completions is correct remains a matter of opinion, but it is certain that in the time taken for decision, the vigor of choice, the side remarks made in choosing, the tolerance and intolerance toward the other points of view, and the capacity of defending the point of view taken, a quick insight into the opinions, the trends, and perhaps into the essential character of the individual is possible.

It is not my intention in this paper to take up in detail the results of the tests, or to describe all the tests I have been using. *The general method* is the subject of this paper, and in order to elucidate it I shall describe one or more of each of three series of tests, each series having a different purpose, and each of the tests

specializing in the effort to elicit specialized attitudes of the individual. It is my belief that the method has great value not only in the testing of normal persons, but perhaps still more in the examination of the abnormal—that is, the psychopathic; the psychotic. Further extension into other fields will be indicated not as the result of work done, but as a thesis to be developed by others.

SERIES I — TEST I

A large card, as shown below, is made with three printed lines and three blank lines alternating. The three blank lines are to be filled in from the slips of choice, which are merely long pieces of cardboard arranged opposite the card. Any one of the first group of slips of choice, four in number, fits the first space; any one of the second group, also four in number, fits the second space; and so any one of the third group, of the same number, fits the third space. The three lines to be chosen are to represent what the subject believes to be nearest the truth as he sees it.

Card	Slips
1. The man who lives a pure life	*Will miss a lot of fun.*
	Will gain the respect of all.
2.	*Treads a difficult path.*
	Will be cheated by rogues.
3. As he reaches old age.....	*He will regret untasted pleasures.*
	He will be serene and wise.
4.	*He will still meet with temptation.*
	His children will want bread.
5. After he is gone.....	*He will be a long time dead.*
	His memory will be honored.
6.	*His struggles will be ended.*
	He will fill a pauper's grave.

For example, a typical story will read:

1. The man who lives a pure life
2. *Will gain the respect of all.*
3. As he reaches old age
4. *He will be serene and wise.*
5. After he is gone
6. *His memory will be honored.*

Lines 2, 4 and 6 have been selected from the slips of choice to fill in the blank places; thus a coherent story has been made, the added lines are in harmony, there is no crossing from one group of ideas to another, and the whole stands as a point of view.

As technic I lay out the card with the slips opposite, and each of the three groups of slips opposite each space (it makes the tests almost too complicated to mix up the groups so that a slip which belongs in Line 6 is opposite Space 2; however, aside from the

fact that the cards correspond to a space within the group, I usually arrange the slips so that corresponding ones do not stand in corresponding places in each group). I then say to the subject, "This is a story with three lines missing. Any one of these four slips (indicating the first group) belongs in place of Line 2; any one of these (indicating the second group) belongs in place of Line 4; and any one of these (indicating the third group) belongs in place of Line 6, and ends the story. Fill out the story as you believe to be the nearest the truth."

It will be noted that the slips fall into four groups telling different stories: one which I call the *conventional* is—"the man who lives a pure life will gain the respect of all; as he reaches old age he will be serene and wise; after he is gone his memory will be honored"; the second, or *naturalistic,* is—"the man who lives a pure life treads a difficult path; as he reaches old age he will still meet with temptation; after he is gone his struggles will be ended; the third, or *cynical and humorous,* is—"the man who lives a pure life will miss a lot of fun; as he reaches old age he will regret untasted pleasures; after he is gone he will be a long time dead"; the fourth, or *pessimistic,* is—"the man who lives a pure life will be cheated by rogues; as he reaches old age his children will want bread; after he is gone he will fill a pauper's grave." While these are, as it were, separate stories representing different points of view a subject may cross from one to another, as is often done between the conventional story and the naturalistic, for example—"the man who lives a pure life will gain the respect of all; as he reaches old age ***he will still meet with temptation;*** after he is gone his memory will be honored." The underlined words belong to the naturalistic story, but have been incorporated by the subject because it expresses his point of view.

Then I tell the subject, "Now arrange the other stories in order of your choice, or their acceptability to you." Some will say, "I don't accept any of them"; others may accept one or two, and still others will accept all, and arrange them in the order of their merit and acceptability. If a subject refuses to accept certain stories I take the first slip belonging to the story, place it in the space and say to him, "Now fill out the rest of the story as if you accepted it." To some this presents no difficulty, to others there seems to be an obstacle mentally toward the completion of the unwelcome or unacceptable.

The conventional, optimistic story is perhaps the most common choice among the group of people I have studied (physicians of the Psychopathic Hospital, psychologists, social workers, other normal people of rather high intelligence, and an occasional patient). Next

in order of frequency is the realistic or naturalistic (treads a difficult path, etc.); this is almost always accepted by scientific workers as their first choice. More rarely, but not infrequently, is the cynical, comic (will miss a lot of fun, etc.). Very rarely, indeed, is the pessimistic (will be cheated by rogues) chosen as the first in order of acceptability. The reactions of the insane to the tests are very interesting, but, as has been stated before, this paper is not concerned primarily with the results. It may be stated that what can be ascertained are: (1) the method of choice — for example, some persons use the trial and error method, others deliberately survey the whole field, mentally arrange all the four groups before taking a single one, and between these two groups all intermediate types of choice are shown; (2) the time of choice, which varies from the very slow reaction of those who show tremendous blocking to those who are exceedingly quick and certain in their choosing; (3) the firmness of decision or resistance, which is manifested both by the manner of picking up the slips and by the comments of the subject; (4) the trend of opinion (conventional, naturalistic, cynical, comic and pessimistic); (5) the catholicity of opinion (that is, the ability to find all of these choices acceptable in part at least); (6) often the history of the patient and his life experiences are revealed in the comments and what I call the externalized introspection of the subject as he chooses. Together with the other tests of these series a very interesting and quick orientation into opinion is reached. Many subjects are extremely anxious to debate the question of their opinion with the examiner. This, of course, is not encouraged.

SERIES II — HUMOR TESTS

In this series the attempt has been made to arrange a series of jokes, witty stories, satires, fables, etc., which shall test the person's capacity to select the "point" out of the material presented. A humorous story is presented up to just before the "point" and then a series of endings is presented from which the subject is to conclude the story. I call these series "constructive humor tests," realizing, of course, that humor (used as a generic term for the comic and the witty as well as for pure humor) is a matter of situation and mood, and may be lost by being approached as a problem. In selecting the tests of a Series I had in mind the fact that strong contrary feeling aroused by a story destroys the feeling of humor; for example, if a story reflecting on Catholicism be told to a Catholic, anger is the result rather than laughter — similarly, the German people would probably not enjoy the current jokes on the Kaiser, and obscene jokes will shock rather than amuse a modest woman. *The tests then offer a means of reaching complexes, but I shall not insist on this purpose of the tests here.*

SERIES II — TEST I

A simple play on words (from Freud).

CARD	SLIPS
Two men met outside of a bathhouse. Said one to the other, "Have you taken a bath?"	*Have you?*
	Why should I?
"No," said the man addressed—	*It's not New Year's yet.*
.....	*Is one missing?*

The original joke read: "Two men met outside of a bathhouse — said one to another, 'Have you taken a bath?' 'No,' said the other, 'is one missing?'" This, of course, is a play on the word "taken," and the naïveté of the man taking the unfamiliar use of the word "taken" in connection with a bath betrays his unfamiliarity with bathing, and his possible connection with stealing. We may safely assume that he does not often bathe, and that possibly he steals.

Of the other answers given, "It is not New Year's yet," refers to the chestnut, "I take a bath once a year whether I need it or not." This is frequently chosen as the proper ending for the story. Strange to say, so are the other two endings — "Have you?" (which is entirely pointless, or else impertinent)—"Why should I?" (which is merely simple or foolish). There are persons who see the "point" like a flash, others have great difficulty in deciding, and these usually pick the wrong answer. Almost every one sees the "point" once the word "taken is emphasized to them.

SERIES II — STORY IV

CARD	SLIPS
Voltaire and an Englishman decided life was made up of more pains than pleasures, and that it had no purposes that man could see, and nothing to justify the suffering. They therefore decided to commit suicide together.	
On the next day, and at the place appointed, the Englishman appeared, but no Voltaire! After looking high and low the Englishman went to Voltaire's house. There he found the sage seated at a table set with a delicious meal and reading a naughty novel with very evident enjoyment.	*Today I feel well.*
	Today my digestion is good.
	Today my bowels moved freely.
	Today I am happy.
"But," said the Englishman, "This is the day we were to commit suicide." "Oh," said Voltaire, "That was yesterday"—	*Today I see that suicide is sin.*
.....	

The original story ends, "Aujourd'hui j'ai bien operé," which is here translated—"Today my bowels moved freely." The point lies in the homely observation that unhappy mood and philosophical pessimism often depend on an overloaded colon. This belief is often expressed in crude language all over the world, but its relation to pessimistic philosophy is very neatly put in the story. The Englishman with his insistence on keeping an appointment emphasizes the humor of Voltaire with his easy transition from pessimistic philosophy to care-free enjoyment of the good things of life.

Most people, however, avoid this ending, either through disingenuousness or esthetic prudery. "Today my digestion is good" suits them better, but this answer lacks the direct and pungent humor of the original, and is an euphemism. Those lacking in humor select, "Today I feel well"—or, "Today I am happy," which, of course, explains why Voltaire did not keep the appointment for suicide, but carries no surprise nor brusque wit with it. Only one person selected the slip, "Today I see that suicide is sin." This person stated that for Voltaire to use such an expression would in itself be a joke.

(In seeking for a method to estimate the constructive humor of the individual I have in mind that pictorial humor is an essential form. I have devised tests for that purpose, but up to the present time have not been able to obtain the artistic skill which is necessary. What is needed is a picture with one part missing — that is, one figure, or person or thing — and to allow a choice of figures, persons or things, all of which fit, but not all of which are humorous.)

As material I have used the story of the peasant who asked for death, and when the monster appeared asked him to help him on with his load of wood; the malicious, and almost obscene, joke in Freud about the prince who made insinuations about the virtue of the peasant's mother and the retort which crushed him, and other stories ranging from pure satire (such as Bjornsen's story of the satirist who was killed by his friends)—to the choice absurdities of some of Mark Twain. It is remarkable how quick some minds are at selecting the point from the various types of answers given, and it is equally remarkable, though quite pathetic, how others miss it entirely. One might write a humorous book about what people think is humor. On the whole, the results of the tests correspond to the reputation that the individual bears in most cases; nor does it seem as if there were any great difference in the sense of humor of men and women, except that women have a more restricted field in which they are *allowed* to find humor. That is to say, public opinion and training conspire to inhibit through modesty, and similar feelings, the explosion that attends the risqué, the obscene, and the too daring.

It probably has been noted that the form of the humor-choice tests is different from that of the first series. This is because it was found that there was too great a limitation placed on the field of the tests by restricting the form to that of the interrupted story, and that it was possible to present a more coherent and concrete situation by the plan of telling a story up to just before its very end and climax. This plan was followed in the next series of which two examples are here given. This series deals with situations in which the ethical standards of the individual are involved by his choice of a completion.

SERIES III — STORY A — ETHICAL TESTS

CARD	SLIPS
A man discovers that the one he believed to be his best friend withheld information from him some time in the past, which resulted in his losing a fortune and to the financial advantage of the friend. Now he receives information which if he transmits it to the "friend," will enrich the latter, but which if he does not, will ruin him.	*He withholds the information.* *He transmits the information.* *He transmits the information on condition that the other first make restitution.*
.....	

The subject is told, "Here is a story told without the ending — on these slips are endings; choose the one first which is nearest to what you consider the ethical or ideal answer to the problem of the story, that is, choose what one ***should*** do in such a situation. Second, then choose what you think you would do, whether it is ideal or not. Third, what do you think the majority of people would do."

As will be seen, the answers to the problem here advanced indicate: (1) revengeful conduct; (2) forgiveness of a thoroughly "Golden Rule" type, and (3) compromise conduct. Many of the subjects point out in all the ethical tests, "You can't tell what you really would do in real life." Of course, life is different from any test, yet as a means of eliciting earnest opinion and debate this method, especially in these ethical questions, gives quite remarkable results. Warmth of opinion is always manifest, and, as has been before stated, the attitudes, the little speeches which burst extemporaneously from the lips of subjects, the evidences of doubt and indecision are illuminating and interesting.

Most people find it easy to say to transmit the information in the problem is the proper conduct, that is to say, the thoroughly "Golden Rule" conduct is proper, but of these the majority pick out as *their* conduct the compromise — that is, the one in which the man that has

been wronged makes a deal with the other. They feel themselves too weak to practice such lofty ethics, and do not seem particularly ashamed of it. In other words, what is inferred is that the ethical conduct is too lofty for human capacity. A lesser number deliberately say that they believe it to be better ethics to force restitution — they reject the idea that compromise with some ethical ideal is involved, what they wish is restitution, the punishment of the guilty, and this they say redounds to the good both of society, and the two parties involved in the problem. One man went so far as to state that the ethics of the "Golden Rule" was not only impracticable, but that it was wrong, that punishment of the guilty is necessary for the guilty man as well as for society. To condone the wrong by giving freely to the man would have led the way for the complete demoralization of the man's character. The majority of these people, that is, those who believe that the compromise is indicated, do not believe in any rigid code of ethics or morals, they take entirely the stand that ethics is custom made obligatory.

No one of my subjects believes that revenge, that is, the non-transmission of the information, is good ethics or good policy. One said he would have taken revenge, and others said that they would for a long time be tempted to do so. Usually the rejection of the revenge idea is prompt and without conflict.

SERIES III — STORY D

CARD	SLIPS
A young woman is married to a man fifteen years older, with whom she lives very unhappily because of utterly incompatible temperaments. Though they have no children he refuses to consent to divorce. She loves and is loved by a young man who in temperament and person would make an ideal mate for her. The young man begs her to run off with him.	*She feels that she must keep her contract and stays with her husband.* *She decides there is a higher law and goes with her lover.* *Unable to decide, she stays with her husband, but meets her lover secretly.*

It will be seen that there is here a conflict between rigid duty as conventionally defined, and personal freedom — the reaching out of the individual for happiness. The ending — she remained with her husband — may be taken as either a triumph for conventional morality (seventh commandment), a triumph for the conception that the stability of the home is the stability of the State, or as the result of a belief that under the present conditions no real happiness would come

to a woman if she eloped with her lover. There is further the viewpoint expressed by Catholics, for example, that marriage is a sacrament, and that no human misfortune or misfortunes should interfere with it. On the other side are those who feel that to go with the lover is more moral than to remain with the husband (the familiar, though very modern, conception that only love sanctifies marriage, and those who believe that the growth of the individual is not to be gained through repression of the sex instinct). There is also the point of view that since the woman has no children she has no duty in the case except to make herself and her lover happy. Some point out that the unhappy home is worse for society than the broken home; and still others (a very few) said that the husband's tyrannical possession is a cruelty and tyranny, against which revolt is socially necessary, and that unless she leaves him a tyrant triumphs, which is bad morals. Whether or not French people would regard the triangled household — that is to say, the compromise situation, where the woman stays with her husband, but meets her lover secretly — as worse than elopement I do not know. At any rate, all of my subjects felt that the lack of personal honor involved in maintaining domestic and sex relations with one man, while the mistress of another, was thoroughly unethical conduct, and to be condemned. However, most admitted that it was very common, and quite human.

What appears with striking emphasis in the series of ethical tests (which embraces a "vow" situation, a life and death situation in which choice rests between chivalry and the good of the greatest number principle, a legal situation — where the choice lies between the "let the law take its course" attitude, and private justice, etc.), is that there is a large group of intelligent people who believe that ethics and morals are merely codes of relative value, and that the private individual has a right to judge for himself. These people have discarded the sin idea, and undoubtedly an investigation carried out in a large mass of people would show that the sin idea is not nearly so common as in previous times. Nevertheless, these same people are very much bound by the conventional code, and it seems evident that inhibitions and judgment thus set up probably control their conduct. Some frankly say that to be in conformity with the group is necessary to them, despite what they may "think," and that therefore they follow, and would follow, the established code.

As I have not as yet tested many people in the ordinary walks of life I cannot say how far the sin principle is involved in judging ethical situations. Amongst Catholics it is very strong, even after so-called liberal education. Whether it is as strong in other religions I am in

no position to state. Most of my subjects take their religion very lightly, many claiming their "own religion"—or "none at all."

As I have stated, the revenge ethics, or revengeful conduct, is largely rejected by these subjects, but in one situation where a man had to choose between helping his wife or pursuing the ruffian who had assaulted her, some men thought it necessary to relegate the care of the wife to others and pursue the assailant. Here was the only situation where revenge appeared as ethically justified to many subjects — that is, the anger evoked by even imagining a situation where a wife was beaten by a ruffian brought about a primitive code of ethics.

SOME THEORETICAL CONSIDERATIONS

The method of multiple choice has for its central point of technjc the presentation to a subject of an unfinished story, embodying some situation, and allowing him to choose from a group of completions to the story the ending he prefers. The ending he prefers indicates in part his attitude, judgment or opinion concerning the situation. His tolerance to other points of view, his decision or indecision, his desire to amplify or defend his choice, his externalized introspection are of great importance in estimating his attitude. It is, of course, true that people are not candid, that they may seek to pick out the answer which will please the examiner, but my experience seems to show that a series of tests breaks down this tendency, that especially the impersonal presentation on slips of paper of various choices overcomes these difficulties very successfully.

The interest the tests arouse produces some very clear thinking in persons whom one would not associate with careful consideration of broad, ethical problems. This leads me to extend, in my mind's eye, the field of its usefulness. That is, it seems to me that there are important fields of activity in which tests are used, in which a change in the direction of multiple choice would be of value.

For example, take education. Throughout the school career of the child, and even through college — whether academic or scientific — examinations are conducted on the memory system. A question is asked and the scholar must ransack his memory for facts on which to answer. Emphasis is laid on his ability to recall facts, and the capacity for presentation of these facts constitutes the ability by which he is marked and judged. But this is obviously an overemphasis of the place of mere memory, and the examination awakens not interest but rather strain. The range of the so-called voluntary associations is tested — the range of the induced associations is not touched. Now these induced associations are the most important in

real life — one depends on face-to-face association, suggestions, criticism and comparison to awaken the stock of facts, ideas and judgments at one's command. What I mean to emphasize is this — that merely asking a scholar a question about a subject is not sufficient to awaken in the majority of persons anywhere near the total or even the most valuable of their associations with that subject.

Therefore, it seems to me that at least in many fields of study the memory system of examinations might well be supplemented by the multiple choice method. The evaluation of an author, an historical event, a scientific theory, ethical teachings and principles — all these would be legitimate fields for its operation. For example, there are varying sets of opinions regarding Tennyson, Dickens, Ibsen; varying sets of evaluations of the results of the French Revolution, likewise different opinions on the influence of Napoleon or Darwin. Themes of heredity can be placed in a few groups, and almost any subject can be presented in a few standardized groups, and the student asked to choose between them (or else to make up his own opinion, and to give his reasons). He would thus be confronted by a segment of real life, he would be asked to choose, to think, to decide, to *act,* in a sense, since his career somewhat depended on his choice. He would be "keyed" up, interest awakened, judgment invoked, and a dozen considerations and emotions not usually touched by the ordinary examination would come into play. The individual as a whole would be tested, mere memory and the grind and crammer would be in less evidence than at present. Perhaps another way of putting the matter is this — the energizing of mentality is partly from within, but largely from without. The memory type of examination depends on the internal, so-called voluntary energizing; the multiple choice system, by providing the student with several opinions to choose from, would act as the external energizer. It would be like placing the student face-to-face with men of different opinions, and asking him to choose, either to accept one set of opinions or to act as judge between them.

Nor is the value of such a method limited, in my opinion, to tests for examination purposes. The teaching method itself should involve choice, if only the constant choice between what is correct and what is incorrect. Commonly made errors in spelling might be placed side by side with the correct spelling, and the children taught to pick out the correct (after first learning the correct). Here there would be a background of error against which the correct would stand out in great contrast. Memory would be called on, but the memory image would be more firmly established because of the necessity of choice. In the same way arithmetical problems could be presented. Tables of

measures could be fixed very firmly in the memory, and I venture to say, much more quickly established by awakening interest and keeping attention alive than by the mere memory system. So would the teaching of declensions, conjugations, and many other matters. It is, of course, understood that the choices to be made would be exceedingly simple in the earlier grades, and become more complicated as the student advanced. What would be gained in interest, in sustained attention, and the growth of critical judgment would be of great value in attaining the goal aimed for — real education.

SPINAL CORD INJURIES IN WARFARE; SYMPTOMATOLOGY AND DIAGNOSIS

A CRITICAL REVIEW

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INTRODUCTION

The exceptional opportunities which the war has offered for observation of injuries to the nervous system has resulted in a voluminous literature on the subject. It appears that brain and peripheral nerve injuries have been relatively more numerous than cord injuries, yet

no greater advance in organic neurology can be signaled than that resulting from a study of these war injuries to the spinal cord.

In support of this statement, we would mention the revision of Bastian's law as regards cord transection, the automatic bladder and rectal functions of the spinal cord, the automatic cord reflexivity as evidenced by defense reactions, tendon and skin reflexes, the syndromes of cord injuries at different levels, the production of organic injuries by direct and indirect concussion, alterations in the cerebrospinal fluid from the same cause, destructive changes brought about in distal parts of the cord by direct injuries from high powered projectiles, an increased knowledge of the course of sensory fibers as evidenced by numerous cases of Brown-Séquard paralysis and radicular injuries and a better understanding of the cause and nature of so-called trophic lesions complicating spinal injuries. In the scheme of this review the subject matter is arranged under convenient headings and repeated references are made to some of the more important articles.

Attention is called to certain of the larger works dealing wholly or in part with cord injuries. The Books of Roussy[1] and Leri[2] have been especially reviewed in Nos. 1 and 2, respectively, of this year's ARCHIVES. Cervical syndromes are the subject of a Paris thesis by Rouquet.[3] The articles of Holmes[4] and of Collier[5] as well as of Head and Riddoch[6, 7] are noteworthy contributions to the war literature of cord injuries. Such comprehensive works as these are rather subject to outlines than reviews and reference to the originals are necessary for a full grasp of the subjects as presented. Advantage has been taken of a number of excellent references and works reviewing the recent war literature. Among these may be mentioned the War Supplement of the Index Medicus, War Surgery of the Nervous System from the Office of the Surgeon-General, Neuropsychiatry and the War by the War Work Committee of the National Committee for Mental Hygiene, Progressive Medicine, Practical Year Book series (Nervous and Mental Diseases), the Quarterly Cumulative Index of *The Journal of the American Medical Association* and the Medical Supplement to the Daily Review of the Foreign Press General Staff, War Office, London.

In the scheme of this review the organic injuries, including cord concussion, are alone dealt with, the various spinal manifestations of the psychoneurotic states (so-called shell shock) not being considered. Treatment and operative indications are discussed only incidently in relation with the neurologic aspects of symptomatology and diagnosis.

Injuries (Direct and Indirect)

I. PATHOLOGY

Holmes pictures the pathology in a case of transection of the cord. The divided cord ends are swollen, irregular and soft to the touch. Microscopic examination shows severe and extensive changes for at least half a segment above and below the lesion and often further—normal structures not being recognizable. Ruptured disintegrating axis cylinders, and both globules and masses of myelin are seen, the latter being soon absorbed by scavenger cells. Hemorrhages are usually found in the softened areas more marked in the gray matter, but are evidently not an essential feature of the condition. The most striking feature in the sections is the presence of large spherical or irregular cells, obviously compound granule cells originating from neuroglia tissue. A proliferation of connective tissue about the smaller blood vessels also occurs. The secondary changes are degenerative rather than inflammatory and are due to edema and circulatory disturbances, edema being the most important factor. The distal lesions are mostly edema and softening and appear to bear no relationship with the severity of the wound. Hemorrhages are generally present, they are punctiform but frequently larger; but no large central longitudinally spreading hemorrhages as understood by the term hematomyelia are found. A striking picture is the swelling of axis cylinders in groups or in isolated fibers. The nerve cells show degenerative changes. Irregular focal patches of simple necrosis may occur as far as four or five segments from the wound, generally in the periphery of the white matter and accompanied by edema. Less complete and irregular lesions of the white matter are more common and practically present in every case. Circular vacuoles, single or in groups, occur, due to swollen axis cylinders. In half the cases, cavities in the dorsal columns, cylindrical or oval in cross section and of considerable size are found in adjoining segments sometimes over four or five segments. The tissues about them are compressed. Although the cavities contain disintegrated myelin and swollen axis cylinders their chief effect must be due to the pressure they produce.

Mussen[8] studied nine cases of cord specimens by means of Bielschowsky's silver method, Mallory's frozen section method, Marchi, Herxheimer's Scharlach R, and Marchi counterstained by Mallory. Among these cases was one of transverse division, one of hematomyelia, syringomyelia, hemisection of the cord; and concussion and contusion cord injuries. In the case of transverse division a peculiar wave-like condition of an axon is described due to vibratory concussion effect. Excellent plates showing characteristic degenerative

swelling of fibers, proliferation of glia, etc., accompany an excellent descriptive presentation of his subject.

The gross as well and the finer pathology of direct injuries is presented in a clear manner in the work of Roussy and Lhermitte.[1] In this work the pathology of concussion is also dealt with in detail, for the pathology of direct concussion is closely related to, or identical with, the distant lesions of direct injuries. In the main features of these lesions the writers agree that they are primary degenerative and not inflammatory, or secondary to vascular lesions.

II. GENERAL SYMPTOMALOGY

Very early in the war, particular attention was given by neurologists to spine and cord injuries because of their special character and complications. Most of the writers made common mention of the poor prognosis and high mortality, and the particularly distressing state of these patients. Paralyzed with loss of sphincter control and often suffering intense pain, they presented a pitiful picture. The transport of these wounded was a matter of serious moment. Schmieden[9] in the assembly of military surgeons in Strassburg early in 1915 pointed out the danger of complications arising or already existing. He believed that in from eight to ten days a decision should be reached as to whether or not an operation should be done. It was soon evident that Bastian's law, or rather the converse of this law, was not a reliable guide, namely, that a flaccidity and an areflexia of the lower extremities denoted complete cord section. Thus Muskens[10] of Amsterdam in two cases of this kind which were operated on described an intact dura which, however, did not pulsate. Pulsation returned after operative intervention and a certain improvement of symptoms also. Oppenheim[11] pointed out that a diagnosis of total section of the cord was not always possible as the accepted signs of this condition were not trustworthy. This writer makes especial mention of pains of great severity in cord lesions—"bladder cramps" of fearful intensity occur. A number of writers report clinical examples of cord injuries in articles dealing with war injuries to the nervous system (Saenger,[12] Babinoff,[13] Derby[14]). In the Bradshaw lecture by Symonds[15] these injuries are considered mainly from the surgical standpoint, an important contention of this writer being the comparatively slight risk of meningitis in septic wounds when treated by the open method.

Important American articles are by Collins and Craig[16] and by Craig.[17] Craig contends that contusion and concussion of the spinal cord may present identical pictures at the onset but may be differentiated usually within twenty-four hours. Concussion is usually charac-

terized by more profound motor than sensory paralysis. Concussion is attended by numbness and tingling in the affected extremities. In the foregoing references most every type of paralysis is represented—paraplegia, hemiplegia, monoplegia, tetraplegia, etc.

Barré[18] early in a careful clinical study of ten cases of cord injuries in which the principal syndromes and types are recapitulated in table form, observes that the clinic picture is practically the same whether the injury is due to bullet wound, schrapnel, bursting of a shell or exlosive bomb. Guillian and Barré[19] give some interesting statistics in 225 cases of cord injuries observed by them in the Somme offensive from July 1 to Dec. 1, 1916. One hundred and thirty-eight patients died; 87 were evacuated to the hospitals in the rear. Of the 138 fatal cases the regional distribution was as follows: Cervical lesions, 12 cases; superior dorsal, 43 cases; inferior dorsal, 51 cases; lumbar and sacral, 32 cases. Nine cases of Brown-Séquard paralysis were observed—they all recovered. The cauda lesions showed a tendency towards gradual improvement. Total cord section was relatively rare.

Holmes[4] has studied clinically 300 cases of gunshot injuries of the spine. He lays considerable stress on the segmental localization of lesions by the determination of motor paralysis and states that this method is as dependable as the usual method of determining the upper border of sensibility disturbances. This is illustrated by a number of clinical cases. Loss of vibratory sensation may also aid materially in location when the dorsal columns alone are damaged. In a study of *muscle tone and reflex* action in cases of severe cord injuries, it was found that the early condition is one of flaccidity of the lower limbs as early as one day after injury. The knee and ankle jerks are lost and remain so for a considerable period (six to ten weeks, period of observation of writer). The abdominal and cremasteric reflexes are more easily abolished than the tendon jerks. In particularly severe injuries no movements of the toes may result either in flexion or extension (Babinski sign) and this condition may persist for weeks. The state of the reflexes and absence of the Babinski sign in severe but not necessarily complete anatomic lesions is explained by spinal shock. In less severe lesions in the early stages, a reflex is described as a "unisegmental reflex" of flexion of the toes, or flexion of the toes associated with contraction of the hamstrings by stimulation of the receptive field of the first sacral segment in the sole. Automatic spinal reflexes of the nature of "mark time" or "steppage" movements are noted only when the lesion involves the upper lumbar segments of the cord. Herpes is found not infrequently at or above the area of sensory loss.

According to the spinal localization certain characteristic symptoms were noted. For example, hyperthermia in the superior cervical cord (at C_4, 104 F.). At D_1 and D_2, marked and persistent increase in the pulse rate. In the middle dorsal region uncontrollable vomiting: Between D_5 and D_8 polyuria, these two latter symptoms being due to disturbed sympathetic nerve function. An *inferior cervical syndrome* is described in detail in lesions of this region of the cord. It is characterized by hypothermia, slow pulse, lowered arterial pressure, scanty urine and a general state of stupor.

According to Collier[5] an important place must be assigned to intradural hemorrhage which has a tendency to collect at the end of the dural sac causing lesions of the cauda by compression and anemia. The state of the plantar reflex is described as follows by this writer:

> There may be four consecutive stages in the condition of the plantar reflexes following a transverse lesion of the cord: 1. An initial extensor response. 2. Either a complete absence of any reflex, which may be the result of shock or of isolation alteration, or a reduced flexion reflex which is the result of isolation alteration which may come on rapidly. 3. The extensor response which when persistent is indicative of a less severe lesion or alternatively of more recovery than the reduced flexion reflex. 4. The normal flexion reflex which returns when recovery is complete. I have repeatedly observed the successive changes from no reflex to the reduced flexion response, and from this to the extensor response in cases in which some improvement is occurring; and conversely I have seen the extensor response change to the reduced flexion response and the subsequent loss of all reflex action in severe cases which were not improving, and in which the only attributable cause for such a change seemed to be the long-standing isolation of the distal segments of the cord. The condition of the plantar reflex is therefore an index of the severity of the damage to the spinal cord and an important early indication as to whether recovery is occurring or not.

Contractures of the feet are discussed by Collier.[5] There are three principal types: (1) Dropped foot with retracted toes; (2) retracted foot with retracted toes, and (3) dropped foot with dropped toes. This latter type associated with reduced flexor response indicates a more severe lesion than the drop foot with retracted toes associated with the extensor response. The calcaneus position with retracted toes is usually persistent and accompanied by increase of anterior tibial and hamstring jerks and loss of knee and ankle jerks. The extensor toe reflex and withdrawal reflex are present.

A *cerebrospinal hypertension syndrome* is described by Claude and Meuriot.[20] It is occasioned by a violent trauma in the posterior cervical region causing contusion and concussion of the cervical cord. The following symptoms occur after a considerable interval:

1. General signs of intracranial pressure including hyperemia of retina or papillo-edema.

2. Local signs of nerve or radicular compression in the cervical region, namely, sympathetic irritation, sensory root disturbances and changes in tendon jerks. Lumbar puncture acts curatively. In civil practice Schachner[21] reports a case of gunshot injury of the cord at the fourth cervical vertebra successfully operated on. He embodies in this article a review of previously existing notions regarding these gunshot injuries with a good reference to the literature.

State of Sensibility.—Numerous cases of Brown-Séquard paralyses have been reported and special *case studies* made by Roussy,[22] Mouzon and Paulian,[23] and Gerstmann.[24] In two cases of syringomyelic dissociation of the sensibility diagnosed as central hematomyelia by Souques and Megevand[25] the medicolegal aspect of these cases is discussed on the possibility of later cavity formation and production of a syringomyelia of traumatic origin. A case of isolated thermic analgesia in the right lower extremity in a cord injury without any considerable motor impairment led Rothmann[26] to believe that the lesion was more or less superificial in the anterolateral column of the cord on the left side at D_1 or D_2. From a study of this case the writer concludes that in cases of obstinate neuralgia in the lower parts of the body section of the anterolateral column might afford relief without fear of accompanying paralytic phenomena.

Holmes'[4] study of the sensibility in his clinic cases led him to the belief that in the middle dorsal region the fibers conducting pain and temperature decussate rapidly and probably entirely within one segment. In the superior dorsal region the decussation occurs within two segments, but in the cervical cord the fibers transmitting pain sensation do not entirely cross for five or six segments above their point of penetration and the fibers transmitting temperature until four or five segments above. Collier[5] believes that sensibility paths do not cross below the last dorsal segment, therefore a lesion at L_1 or below cannot produce a Brown-Séquard paralysis.

Interesting are the observation and conclusions of this writer on the vexed question of the topography of spinal anesthesias as compared with peripheral anesthesias. He states that in spinal lesions the upper limit of sensory loss is in a line more or less transverse to the axis of the limb commonly designated as "segmental," "glove," or "stocking" type, whereas in lesions of the spinal roots the sensory loss is longitudinal with the axis of the limb, the so-called "radicular" type. In unilateral lesions the bilateral sensory loss in the region of the lesion is narrower for pain and temperature than for touch, and this is even more pronounced in the dorsal than in the cervical region because of the increased obliquity of the crossing fibers. In most cases of unilateral lesion the vibration sense has been most affected

on the side contralateral to the lesion both in severe and slight lesions. There are three principal types of objective pain: (*a*) Dull and persistent; (*b*) lancinating, and (*c*) severe paroxysmal cramps.

State of Bladder.—The state of the bladder and its reflex action is so uniformly associated with the cord lesions that it perhaps should be classed among symptoms rather than complications. Head and Riddoch[7] studied the action of the bladder in these injuries. In complete cord division the bladder may begin to act automatically as early as twenty-five days afterward. In chronic septicemia, such as from chronic cystitis or pyelitis, bed sores, etc., automatic micturition may never take place, but when, however, it is established fluid injected into the bladder is reflexly expelled when amounts between 100 and 600 c.c. have been introduced. Even in the period of complete retention the bladder wall may contract from stimulus of a catheter and expel urine through it. Retention is due to spasmodic contraction of sphincter mechanisms. In lesions above the lumbar region scratching of the sole, thigh or abdomen may produce a flexor spasm of the extremities accompanied by discharge of urine. Following a lesion of the lower lumbar and sacral roots, the automatic bladder is not thusly influenced reflexly by afferent impulses but the patient may be aware of tension within the bladder. Pressure on the automatic bladder through the abdominal wall serves not only to facilitate evacuation mechanically but also as a reflex stimulus.

In a large number of spinal cases (450) Walker[27] describes four bladder states: (1) Retention from paralysis of the detrusor muscle; this leads to (2) retention with overflow; (3) periodic reflex micturition after a certain quantity accumulates— state of the infant's bladder; (4) paralytic incontinence when the bladder is flaccid and the sphincter atonic. This takes place when the lumbar centers are destroyed. Complete retention is the first phase of all spinal lesions in which micturition is affected and occurs also in cauda lesions. Periodic reflex micturition is the second phase. In considering treatment which is well presented in detail the indications are along two chief lines: that of drainage of the urine, and that of treatment of sepsis when established. In the first indication the tied-in catheter has not been successful in the author's experience, causing irritation and inflammation. He is inclined to favor suprapubic cystotomy in the early retention stage before infection as a prophylactic measure but has not yet tried this procedure. In calling attention to the frequency and seriousness of bladder infection in cases of gunshot wounds of the spinal cord due to infection from repeated catheterization, Besley[28] strongly advises against catheterization. He makes it his practice to permit the bladder to become distended and overflow

stating that this distention is not harmful to the bladder or kidneys and that there is practically no danger of bladder rupture. He mentions a case of removal of a benign cord tumor in which the bladder was distended to the umbilicus for nearly two years, the patient finally regaining control of the bladder function.

III. COMPLETE CORD SECTION

Symptomatology.—Since Bastian's clinical study of transverse cord softening in 1882, most clinicians have accepted his views. He contended that in anatomic interruption of the cord, the limbs below the lesion were in a state of total flaccid paralysis and areflexia, and sensory loss was complete. This condition remained permanent. In a careful perusal of his writings, however, it is interesting to note that mention is made of the existence of a plantar reflex and a periodic discharge of urine. Although there have been certain observers who have questioned Bastian's law, especially as to the permanent loss of tendon reflexes, it remained for the unparalleled opportunities of the war to establish the facts by numerous and careful observations. The subject is presented by Riddoch[6] in a critical analysis of eight cases of complete division of the cord. The course which the cases run is described in three stages: (1) Stage of flaccidity; (2) stage of reflex activity, and (3) the stage of gradual failure of reflex functions. The contents of the bladder and rectum may be voided automatically. A widespread reflex action from afferent stimuli, consisting of flexor spasm of lower extremities, abdominal wall, evacuation of bladder and sweating is designated as "mass reflex" in complete section. The flexor muscles in all phases show more tone than do their antagonists. Comparing the manifestations of complete and incomplete lesions, the author states that there are no manifestations by which we can be certain that the spinal cord has been anatomically divided. But certain manifestations were found in incomplete lesions, not occurring in complete lesions; of such, noteworthy were the difference in character of flexor responses as compared with the "mass reflex"; a slower relaxation phase in the knee jerks; no obvious tonus difference in flexor and extensor groups; and especially the presence of extensor responses designated as postural reflexes, dependent on the integrity of certain descending propriospinal paths. Examples are homolateral or bilateral extension of the lower extremities by stimulation of upper receptive fields or by gently pressing on the sole when the limb is passively flexed (extensor thrust). Further, in these cases of incomplete division, muscular action of the ipsilateral limb is diphasic in character (flexor and extensor) as compared with the uniphasic type (flexor) as seen in complete lesions. In certain cases

of incomplete lesions the action is comparable to the steppage movement of the spinal dog. Tonus of all the muscles is constantly below normal in the resting state after total transection.

A typical example of a case observed by the authors over a long period and described in great detail is briefly abstracted:

> Directly after being wounded the patient experienced the sensation as if the lower part of his body and legs were missing, consciousness was not lost and his mind was clear. Motion and sensation were completely lost in the lower limbs — there existed a flaccid paralysis with loss of all reflexes. This condition lasted for twenty-two days and then he entered on the second stage. Tendon and cutaneous reflexes began to appear. Urine was voided at regular intervals and the rectum began to functionate. Sweating took place in the lower extremities. Riddoch states that this stage of reflex action may exist for months or indefinitely until intercurrent affections change it or end it. Toxic absorption as from an infected bladder or a decubitus may exist even during the initial shock, and this stage of reflex action may never be entered on. The condition is then similar to that described by Bastian. The muscles are toneless and waste, reflexes of defense are wanting and automatic evacuations of the bladder and rectum may be absent or present to only a slight degree. The authors strongly advise early catheterization, as over-distention of the bladder prolongs the state of retention by diminishing the excitability of the detrusor muscle and may cause cystitis or hemorrhage.

Another important article is by Guillian and Barré.[29] These writers report fifteen cases, but their period of observation was a short one; the longest duration of life was forty-one days, and in most of the cases considerably shorter. The tendon reflexes were as a rule abolished, the plantar cutaneous reflexes were generally in flexion and the reflexes of defense were usually absent. Hypotonia was not a constant finding even at the onset. Anesthesia was complete, retention of urine was the rule, but the state of the bowels was more commonly one of incontinence than retention. It was noted that the lower limbs invariably showed an elevation of temperature more marked in the feet. Holmes[4] is of the opinion that in total transverse lesions of the cord the knee and ankle jerks are probably permanently lost. Preservation of muscle tone is an indication that some improvement may be expected in cases of doubtful lesions. The amount of reflex movement obtained by stimulation of the soles varies more or less inversely with the severity of the injury. Claude and Lhermitte[30] report a case with preservation of tendon and skin reflexes; the plantar reflex was first in extension but later changed to flexion. Observations of Dejerine and Long[31] and Dejerine and Mouzon[32] are to the effect that the plantar reflex occurs in these cases always in flexion, and this is interpreted to mean that the pathologic extension reflex of the great toe is not conditioned solely by pyramidal tract degeneration, but an intervention of superior centers is necessary for its production. It appears, how-

ever, from more recent and numerous observations that the position of Holmes and Dejerine et al. is not tenable. Further observation on total cord sections are reported by Gustav Roussy,[33] Claude and Petit,[34] and Buzzard.[35] The last of these observers reports a return of reflex activity below the lesion, whereas the two former report flaccidity. It will thus be seen that the sum total of these observations does not present a uniform picture.

SUTURE OF THE CORD

After anatomic division of the cord a number of attempts to *suture the cord* have been made. Jacob, Girou and Ferrand[36] relate the case of a soldier presenting the syndrome of complete section of the cord in whom operation 130 days after the traumatism revealed a complete division occasioned by a shell fragment at the level of the eleventh and twelfth dorsal vertebrae. After removal of the fragment an attempt to suture the cord and meninges was made, but was only partially successful. Eight days following the operation improvement was noticed, and twelve days after voluntary movements in flexion were noted which increased notably in the period following. The sensibility disturbances receded to a lower level, but retention of urine and incontinences of feces still persisted. In the discussion of the paper, Kirmission, Pozzi and Quenu accepted with reserve the idea of restoration of function by regeneration of fibers or conduction of impulses through the cord. The difficulty of determining complete from incomplete section at the time of operation was emphasized and the improved motor state was attributed to removal of cord compression.

Morat[37] in a special article comments on this remarkable communication of Jacob, Girou and Ferrand. He rejects the idea that any regeneration of fibers could take place in such a short time and suggests the possibility of a functional plasticity of the nervous system through the channels of the grand sympathetic to explain the return of cord function. Mayo Robson[38] suggests on the basis of previous animal experimentation by himself that one may obtain return of function in a paralyzed cord by excising the injured portion and transplanting in the gap the cord of a recently killed animal such as a rabbit. He reports such an operation in a paraplegic with a certain improvement two months following the operation. A further report of cord suture appears in the publication of Collica.[39]

In the light of the nature and extent of certain reflex movements such as defense reactions, actual return of voluntary motion may easily be confused with reflex motion. From this point of view it is questionable whether these cases of restoration of function will bear

critical analysis. On the other hand, it may be said that Lhermitte is believed to have demonstrated regeneration of cord fibers. Furthermore, the by-path or connecting path of the sympathetic nervous system may transmit afferent or efferent impulses to or from spinal cord above the division, from lower regions.

Marie and Foix[40] have studied the *electrical reactions* in cases of total cord section and have noted hypo-excitability to complete loss of reaction in the paralyzed muscles. They have also studied the reactions in incomplete cord lesions. When the electrical reactions are gravely affected the tendon reflexes and defense reactions are lost. The electrical alterations are apt to be most marked in the external popliteal nerve distribution and the absence of the Babinski reflex in these cases is thusly explained in the altered condition of the extensor muscle of the great toe.

Cauda Equina Injuries

Claude and Porak[41] assert that traumatic injuries of the cauda were extremely rare previous to the war. They have recently observed nineteen cases and report a *syndrome*. Characteristic of this syndrome are early atrophy, trophic lesions, dissociation of the genito-urinary and rectal functions, peculiarities of electric reactions and irregularity of the motor and sensory paralyses. The prognosis is, as a rule, favorable, the majority of the symptoms disappearing without operative intervention. The evolution of symptoms is particularly characteristic in three phases: post-traumatic irritation, paralysis, and recovery. The severe paraplegias commence to walk at the sixth or seventh month.

That there are various syndromes following cauda equina injuries is maintained by Lhermitte.[42] He describes a superior or lumbar type, a sacro-lumbar type, and a inferior sacral type; further, a syndrome of hemicaudal injuries and polyradicular syndrome. He emphasizes the tendency toward recovery even in severe cases. Guillian et Barré[43] also note the relatively favorable prognosis in these injuries in which only seven ended fatally in their series, and these by meningitis. Complete paraplegia is not necessarily of grave prognostic import, and in general prognosis is relatively favorable as compared to cord injuries. There is no inversion of the normal heat regulation as is often seen in cord injuries, but over the affected extremities the temperature of superficial parts is lower than normal. In reporting three cases Mingazzini[44] lays stress on the sensory and motor dissociation in the extremities and also in the urinary apparatus. There were curious lesions of certain roots without involvement of neighboring roots. In one of the cases the muscular atrophy was extremely rapid; in another case pain was the characteristic feature.

Roussy and Bertrand[45] report a case of a soldier wounded in the lumbar region and the cauda injured. He was rendered paraplegic, presented atrophy and disturbance of subjective and objective sensibility and a flaccid paralysis. Severe complications in the nature of sacral decubitus and bladder infection were present. There was practical recovery in nine months. In a gunshot wound of the lumbar spine with injury to the cauda, Fearnsides[46] observed destruction of the pelvic autonomic nerves, paralysis of the large intestine and rectum and recurrent attacks of intestinal obstruction, in addition to the usual motory and sensory phenomena. Hassin, Johnstone and Carr,[47] in civil practice, removed a bullet from the cauda six years after the injury, and obtained marked improvement in the predominant symptom of pain. These authors remark on the relatively infrequent occurrence of these injuries in civil practice and review the existing literature on the subject. Schupper[48] also reports a case of cauda lesion. Gamper[48] reports a favorable operative case with rapid recovery.

Concussion

By concussion is meant, not a direct injury to the spinal cord either by a primary wound due to a projectile or a secondary wound such as might be caused by bone fragments or the dislocation of a vertebra or compression, but a condition caused by a sudden mass effect, by a mechanism which is as yet imperfectly understood. The causes and effects are better known. Thus the sudden impact of a high powered projectile striking the spine without injury to the central canal or its membranes may cause profound organic changes in the spinal cord and a grave group of symptoms. This latter example is one of direct concussion according to the convenient classification of French writers (Claude, Roussy and Lhermitte). A second group not so firmly established as the first is designated by them as indirect concussion. In this group belong the cases ascribed to aerial concussion, wind of explosives, and true shell shock, and in which there is no evidence of external wound.

1. Direct Concussion

Here again the neurology of the war has greatly advanced our knowledge regarding spinal concussion. Collier[5] discusses the *mechanism* of spinal lesions by gunshot wounds. The high velocity of a projectile causes a great increase of pressure in the tissues, and if the canal is involved the pressure is transmitted to the cerebrospinal fluid and thereby to the entire nervous system in relation to the canal. In consequence, consciousness is often lost. The projectile is often deflected by the spine, but this does not imply the absence of organic lesions; the shock is transmitted to the elastic intraspinal tissues determining injuries of varying degrees.

The *pathology* of concussion is described by Holmes.[4] When the cord is not damaged by the fracture or dislocation of a vertebra a more or less uniform swelling may be present opposite the site of impact. Microscopically, the vessels are found engorged, and there are punctiform hemorrhages in the gray matter especially. The most striking change, however, is the edematous swelling of the most affected segments with either diffuse or focal necrosis, and softening. Focal softenings also occur in the gray matter, but are unrelated to the hemorrhages. The distant lesions in cases of concussion are similar to those found in direct and contusion injuries, namely, scattered hemorrhages, irregular foci of necrosis, softening and cavity formation, and extensive parenchymatous changes that often extend over four or five segments in either direction. These consist in the swelling of fibers either isolated or in groups. The disappearance of these fibers leaves vacuoles and cavities in the white matter and gives it a sieve-like appearance. The essential changes may be described as primary disturbances in the vitality of tissue associated with edema and small scattered hemorrhages. Secondary changes may occur due to secondary progressive softening or the development of cylindrical cavities principally in the dorsal columns as is seen in distal lesions of direct injuries. It seems probable that they originate from the accumulation under pressure of transuded fluid and degeneration products from a small primary lesion which tracts upward or downward. Waves of pressure in the cerebrospinal fluid may produce physical defects within the cord and possibly disturbance of its lymph circulation, but the explanation of Fickler appears more probable: by impact on the vertebral column, the cord is made to oscillate within the canal and as its movements will obviously not be synchronous with those of the column it may be directly bruised against the walls of the canal, while at the same time the sudden jarring of the cord produces a physical disturbance in its tissues and especially in the fluid axoplasm of its fibers. Marburg[50] believes that there is a tearing of lymphatic capillaries resulting in a traumatic edematous degeneration.

Claude and Lhermitte[51] describe the case of a soldier ultimately dying from injuries caused by shell fragments, a state of paraplegia being due to concussion and not to direct injury. A softening from an ischemic lesion was found in the segments D_4, D_5 with secondary degeneration of the fiber columns above and below the lesion. Ependyma changes due to edema and traumatic hydromyelia were also present and the nature of the neuroglia reaction about the ependymal canal suggested the genesis of the lesions in traumatic syringomyelia. A large hematomyelia due to concussion occupying a distance of six dorsal segments is reported by Jumentie.[52] A bullet traversed the

thorax caused a fracture of the left posterior part of the arch of the third dorsal vertebra, but did not affect the dura or contuse the cord, and did not even produce a hemorrhage into the vertebral canal. Claude and Lhermitte[53] describe six types of concussion of the cervical region of the spinal cord. These are: (1) Severe and persisting quadriplegic form; (2) hemiplegic form; (3) form with brachial monoplegia; (4) form of brachial diplegia; (5) cerebello-spastic form, and (6) defaced forms. The histologic examination showed areas of necrosis both in the gray matter and in the white columns. The marginal cord, posterior coruna and subjacent areas were the most affected. Injuries in this region of the cord are of relatively much better prognosis than in other regions of the cord.

Oppenheim[54, 55] states that when a bullet hits the spine and swerves aside, acute necrosis softening and hemorrhage may occur with intact vertebrae. He has, however, reported several cases in which grave symptoms were only transitory. Bury[56] also reports cases of concussion. In one case the spine was probably injured and there was an initial loss of consciousness. In the second case the soft tissues were alone involved. The cases showed considerable improvement under observation.

Roussy and Cornil[57] have observed two cases of spinal *concussion from dislocation of cervical vertebrae* resulting in quadriplegia and the symptom complex of Claude Bernard Horner. A transcript of their summary of these cases is as follows.

In the first case the cord lesion was produced by a luxation of the atlas on the axis with fracture of the odontoid process, an accident formerly considered fatal by lesion of the medulla. In the second case the lesion was due to a dislocation backward of the fourth cervical vertebra. This mechanism is interesting because Malgaine affirms that backward dislocation of the cervical vertebrae is exceptional. After a period of "spinal coma," lasting one and one-half months in the first case, and four months in the second, the quadriplegia regressed in a crossed manner, motility returning simultaneously in the upper extremity and the contralateral lower extremity. In ten months the recovery in motor function in these cases was practically complete with the exception of a slight left hemiplegia in the first case, and a very slight right brachial monoplegia in the second, associated with a slight paraplegia "fruste" which appeared after fatigue. Further, in the first case a syndrome of Claude Bernard Horner persisted on the left side and in the second a Claude Bernard Horner alternans affecting, according to conditions, sometimes and predominately the right side, sometimes the left. The sensibility disturbances persisted presenting especial characteristics: in the first case there was a hyperesthesia in the innervation of the great occipital nerve, a manifestation of the atlas-axis dislocation which is contrary to the observation of Sicard and Roger, who describe anesthesia in this nerve as a sign of fracture of the atlas. This hyperesthesia was marked in the second case. It affected the radicular distribution of C_2 and great discomfort was felt on local irritation such as by wearing a collar.

Apart from cases of aerial concussion and cases of direct concussion by projectiles coming in contact with the vertebrae, Claude and Lhermitte[58] recognize a class of concussion injuries due to traumatism of the soft parts at a distance from the spine. They report three such cases and conclude from an analysis of the symptoms that the pathology must be the same in this class as in the other class of concussion cases, namely, focal necrosis, acute primary degeneration of myelin fibers, modifications of the ependyma, and degeneration of the posterior roots. Anatomic proof, however, is wanting. In all the observations from the anatomo-clinic standpoint the cord lesions of concussion whether they be due to direct spinal impact or due to actual lesions at a distance from the spine are identical in nature and differ only in degree according to Claude and Lhermitte.[59] They present definite characteristics which render it impossible to confuse them with other affections of the cord. The essential lesions are insular foyers of necrosis, acute primary degeneration of myelin, modifications in the ependyma and degeneration of posterior roots. The mechanism of these lesions is complex and is due to ischemia, to the laceration of nervous tissue and the hypertension and transmitted shock of the cerebrospinal fluid.

In injuries to the neck without spinal involvement Marie and Benisty[60] describe two types of clinical syndromes. First Type: Ir this type the projectile traverses the neck from side to side, the wounded soldier falling forward without loss of consciousness. At first there is quadriplegia with involuntary passage of urine and feces, receding after several days or several weeks to a hemiplegia and finally to a brachial monoplegia, the paralysis being particularly marked in the hand and fingers. The state of the sphincters runs a variable course. There may be severe eschars. There is severe pain which runs a course parallel to the motor paralysis. Objectively are found definite signs of cord lesions: Brown-Séquard paralysis, frequently the sympathetic syndrome of Claude Bernard Horner, exaggeration of reflexes, Babinski unilateral or bilaterally, ankle clonus, incoordination and often a syringomyelia dissociation of the sensibility opposite to the side paralyzed. Definite signs of cord involvement persist in these cases.

Second Type: Lateral wound in the neck, complete loss of consciousness, lack of sphincter involvement. At first flaccid brachial monoplegia to which is added a later oncoming spastic paresis and incoordination of the lower extremity on the same side and of the opposite upper extremity. At this stage sensibility disturbances of syringomyelic type on the side opposite the lesion, and disturbances of deep sensibility on the same side are present. Exaggerated reflexes,

clonus, sign of Babinski are found in the inferior extremity involved. The cause assigned to this type is probably spinal concussion ("commotion").

Bonola reports five cases of lesions of the cord with marked clinical evidence of sensory and motor paralysis of organic type without direct injury to cord or spine. The author explains the method of production of the lesion as due to a violent elongation of the cord by a sudden "redressment" of the spine. The lesions described are small meningeal hemorrhages, tearing of root fibers, rupture of fascicular fibers, fragmentation of cells, etc.

Conservatism toward operations in concussion cases especially when the spinal lesions are doubtful is the position taken by Finkelburg.[62] The disseminated character of the lesions which may extend the length of the cord and the possibility of complete recovery without intervention are the reasons for his position. He reports a spinal injury at the fifth and sixth dorsal vertebrae, occasioning a complete flaccid paralysis in a young soldier. An operation performed three weeks after the injury revealed an intact dura with no cord compression sufficient to account for the symptoms. Death occurred from respiratory failure before the operation was completed. On microscopic examination there was no hemorrhage found.

In the Somme offensive Guillian and Barre,[63] among 200 cases of spinal cord injuries, observed fifteen cases of severe organic paraplegia without evidence of local damage to the dura mater. In almost all of these the vertebral column was injured. The most frequent lesion was hematomyelia either alone or with acute necrosis or softening. All of the fifteen cases ended fatally in from three to five days. There were two principal types: one resembling complete division, and the other of focal spinal lesions. Thomas[64] in an experience in command of the Harvard Unit and observation elsewhere in neurological centers abroad, speaks of concussion effects and believes that the actual extent of the damage to the cord can only be determined when the immediate effects of the injury, and the concussion have had time to subside. He speaks of the favorable prognostic significance of the Babinski sign. The concussion (direct) most often causes an edematous swelling of the cord, disintegration and softening, and hematomyelia.

A residual Brown-Séquard paralysis is reported by Redlich[65] in a soldier rendered unconscious and immediately quadriplegic by a bullet passing antero-posteriorly through the neck to the right of the vertebra prominens. The symptoms which developed fifteen days after injury were motor paralysis on the right side complicated by an inferior brachial paralysis and sympathetic cervical paralysis on the same side

and crossed sensory paralysis. These symptoms permitted a localization of the lesion at D_1 and D_2. In a case of a soldier with a bullet wound traversing the upper part of the trunk, but not involving the spine, Mendelsohn[66] reports practical recovery from a paralysis considered to be organic by treatment with spinal galvanism and faradization of muscles.

Roussy and Lhermitte[67] describe a group of four cases of *spinal hemiplegia associated with a direct injury to the external branch of the spinal accessory nerve.* The main features of this symptom complex are a tardy hemiplegia following the initial shock (quadriplegia or paraplegia), and an amyotrophy of the sterno-cleido mastoid and trapezius muscles. Vasomotor disturbances on the paralyses side and implication of the cervical plexus may be present. The sphincters are at first affected but function is regained, and the hemiplegia diminishes in intensity.

II. INDIRECT CONCUSSION

Although anatomic evidence is lacking to support the contention that organic alterations in the spinal cord occur in cases of aerial concussion there are many clinical cases reported which argue in favor of this contention. The *effect of high explosives* on the central nervous system is presented by Mott[68] in the Lettsomian Lectures. He states that instant death has occurred in groups of men from effects of shell fire when no visible injury has been found to cause it. It has been estimated that the sudden atmospheric depression in such cases corresponds to a dynamic pressure of about 10 tons to the square yard. One effect of this is to liberate nitrogen suspended in the blood and transforms it into bubbles of gas which are driven into the capillary vessels and cause instant death. The writer describes the physiologic effects of shock on the neuron, and the effects of noxious gases. He calls attention to the similarity of symptoms in cases of shell shock with burial and those of CO_2 poisoning. His concluding lecture deals with symptomatology of shell shock which in the majority of cases, notwithstanding a possible organic element, is of predominantly psychic nature. This position taken by Mott appears to represent the views of most neurologists, as can be readily appreciated by even a casual reference to the considerable literature which has grown about this subject.

The *mechanism* of indirect concussion producing, among other nervous phenomena, organic hemiplegias and paraplegias is discussed in detail by Sollier and Chartier.[69] The physical phenomena of the explosion of a shell is explained. Three different zones surround a man in the vicinity of an exploding shell. In the first zone or zone of violent atmospheric vibration, the individual suffers a blow compared to that from a solid object, and death usually results. In the second

zone there is atmospheric compression caused by the vacuum of the explosion. In this zone occurs most frequently hemorrhage of the cord and its envelopes. The third zone is one of decreasing vibrations and the resulting states are comparable to those caused from shock by lightning and electricity.

Soukhanoff,[70] a Russian observer, uses the term "air concussion" of the brain and spinal cord, calls attention to the abnormal state of the cerebrospinal fluid in these cases, and explains the psychogenous and hysterical symptoms as complicating secondary manifestations. Roussy and Lhermitte[67] believe organic changes are more likely to occur in the spinal cord from aerial concussion than in the brain where they are comparatively rare. Roussy and Boisseau[71] believe that in the majority of these cases the symptoms are of the hysteric type and report 133 aerial concussion cases from a total neurological material of 1,300 cases.

In a session[72] of the Paris Neurological Society on April 6 and 7, 1916, devoted to a consideration of this subject, Clovis Vincent "Rapporteur" classified the nervous manifestations occasioned by shell explosions into three classes: (1) Emotional phenomena; (2) commotional (concussion) phenomena, and (3) mental phenomena. In the commotional state, characteristic were: Clinical objective signs immediately following shock; loss of consciousness; modifications in the cerebrospinal fluid and certain anatomic modifications, such as meningeal hemorrhage, hematomyelia and traumatic encephalitis.

George Guillian, in the discussion, was of the opinion that organic changes were frequently detectable by methodic examinations of the motor and sensory systems and the reflexes. He believed that many organic cases were considered as functional. Souques observed two soldiers in whom three months after the commotion a hyperalbuminosis (0.80 gm.) per liter existed, whereas the lymphocytosis had disappeared a considerable time before. André Leri noted as sequelae, jacksonian epilepsy in one case; and in another the clinical aspect of a myopathic atrophy, plus the Aran Duchenne hand atrophy.

Gustav Roussy in an experience of eighty-one purely neurologic cases following explosions, firmly stood in his position that the symptoms following were of functional nature with rare exceptions admiting, however, that the cases of Ravaut, Pierre Marie et Chatelin, Babinski, Ballet, Heitz and others presented organic lesions. The fact that the majority of cases were cured by psychotherapy and also that rarely were those wounded by explosive shells likewise affected, strengthened this observer in his belief of the psychic nature of the symptoms.

Striking examples of organic injuries following shell explosions are found in the reports of such skilled observers as Babinski and Marie. Babinski[73] cites a case of a soldier lying prone in the act of firing and suddenly paralyzed below the waist by the explosion of a shrapnel shell 2 or 3 meters above him. He felt as if his lower extremities had disappeared. There resulted a flaccid paralysis and retention of urine and feces, and he suffered pain in the lumbar region. Twenty-seven days after injury he regained the use of his legs. At the time of observation, nine months after the injury, a Brown-Séquard paralysis was found probably due to hematomyelia in the lower dorsal region from the concussion. Marie and Chatelin[74] diagnosed a lesion of the lumbar sacral cord in a soldier due to a shell explosion at a distance causing a flaccid paralysis of the right lower extremity. There was no nervous shock, no loss of consciousness and the patient continued to walk several hours after the explosion. They compare these accidents to those observed in caisson disease, following rapid decompression. The explosion of a shell causes a brusque atmospheric decompression, determined by Dr. Arnoux by means of an aneroid barometer in the vicinity of an exploding shell. Gaseous decomposition of the blood with gas emboli and rupture of capillaries follows.

Heitz[75] from a study of five cases of paraplegia following the bursting of shells at short range without external evidence of injury concludes that the symptoms are organic in nature. The radicular type of anesthesias, sphincter involvement, absence of hysterical manifestations, and course of the cases leads the author to this belief.

Impressed with the severe internal injuries in a fatal case due to shell explosion without external wound reported by Sencert in the Societe de Chirurgie, Ravaut[76] investigated the *cerebrospinal fluid* in a case of paraplegia following the explosion of a shell, and found blood in the cerebrospinal fluid. In a later article[77] he further reported similar cases all of which showed blood or increase of albumin in the cerebrospinal fluid. From these findings he drew the conclusions that the primary symptoms of shell shock are organic and not psychic in nature. Lerich[78] also finds changes in the cerebrospinal fluid. In cases of concussion with transitory states of torpor and hebetude he has found blood-tinged fluid and a more or less persisting hypertension as high as from 62 to 60 manometer of Claude. This is present in those showing no clinic signs of cerebral concussion. Relief is experienced by lumbar puncture.

A test to differentiate the true concussion cases from the functional shell shock cases is proposed by Weil.[79] In those suffering from true concussion an excess of glucose is found whereas the cell

count is low and protein contents is generally normal. This is not true in the functional cases.

Mestrezat,[80] reviewing Weil's paper, states that in his experiences in recent concussion cases an excess of glucose is not always present. In cases of emotion, furthermore, glucose is found in excess quite as frequently as in concussion. He therefore concurs with Weil in his findings in old cases, but believes that too much importance must not be attached to this phenomenon in recent cases.

Guillian[81] describes an *asthenic syndrome due to concussion* without evidence of focal injury. The symptom complex described consists of a profound physical and mental asthenia at the onset with tendency toward betterment and more or less recovery at the end of four or five weeks. At first, the physical weakness is so great that bed-rest is necessary. In the psychic sphere attention memory and idea association are affected. Insomnia, vertigo, trembling of the extremities, involuntary spasms of muscles, myoclonia, exaggerated reflexes and instability and variations in the pulse rate complete the picture.

Pitres and Marchand[82] maintain that following explosions in the neighborhood there result organic changes in the nervous system. These injuries are the veritable "internal injuries." The cases detailed are those simulating meningitis, general paralysis, cerebellar lesions, multiple sclerosis and tabes. Guillian and Barré[83] in a material of several hundred patients suffering from "shell shock" found, in nine cases, retention of urine and, in three, incontinence of urine. These *sphincter disturbances* appeared to be the only symptoms as there were no disturbances of other reflexes and no motor or sensory paralysis. Meningeal hemorrhages were eliminated as a cause, as was also hysteria, the pathogenesis being obscure. The case of retention cleared in from two to six days, but the cases of incontinence persisted longer.

A transient paraplegia, not classified as functional is outlined by Elliot.[84] At first, there is complete paralysis of the lower limbs, with numbness, hypotonia, and depressed reflexes. The sphincters are rarely involved and the plantar reflex is never in extension. Improvement in sensation and motility returns in about a week and in two weeks or more the patient is able to walk, although complaining of extreme tenderness in the lumbar region and pains shooting up the back.

Leri[85] relates the following: Due to the explosion of a shell of large caliber at a distance of about 30 feet, a soldier presented motor and sensory symptoms corresponding to S_1 and S_2 radicular distribution. The absence of genito-anovesical symptoms and also of those

dependent on a lesion in the lumbar cord enabled a precise localization in the epicone. Leri and Schaffer[86] report a case of hematomyelia of the medulla resulting from aerial concussion. Immediately a Millard-Gubler syndrome developed, complicated by a complex cranial nerve and cord involvement. Considerable recovery took place after about a year leaving predominantly a bulbar syndrome which resembled the usual labioglossolaryngeal syndrome differing, however, from this latter by marked sensibility disturbances of the syringomyelic type. Tetraplegia of poliomyelitic type from air concussion is reported by Gatti.[87] The paralysis was extremely acute. The writer could refer to only one similar case on record, although instances of traumatic poliomyelitis are found in the literature.

Complications and Other Conditions

In commenting on the great danger of eschars menacing the recovery of those suffering from cord injuries, Marie and Roussy[88] maintain that, contrary to the opinions of Charcot, Vulpian and Brown-Séquard, these lesions are not due primarily to an improper cord function, but their causes may be found in exogenous infections and by pressure long continued. Loss of motility, impaired sensation, altered vascular supply, humidity and uncleanliness are contributing factors. They may be considered as *local trophic conditions.* The indications for treatment are immediate and preventative. Opiates should be given when there is incontinence of feces, and when there is an incontinence of urine a permanent catheter should be employed closed at the extremity. In retention of urine a permanent catheter is also advised with the usual methods of fixation and drainage. The position of the patient should be changed hourly during the day and every two hours at night. In case a decubitus has started a drying powder such as a phenol powder may be used. When the bladder is infected irrigations of weak solutions of potassium permanganate or nitrate of silver are advised. Twice daily, after each irrigation, 10 c.c. of *huile goménolée* is introduced into the bladder, the catheter being withdrawn slowly so that the entire urethra may be medicated.

Roussy,[89] considering the question of complications, believes that prognosis more often depends on complications than on the actual spinal lesion itself. He believes that meningomyelitis is rare because in a large number of necropsies he has not seen an example of diffuse infective myelitis or diffuse meningitis after gunshot wounds. The lesions are rapidly shut off above and below by adhesions. Early operative interference is contraindicated. In the medical and surgical society meeting of the First French Army, April 12, 1916,

Roussy[90] read a paper on cord injury complications, especially mentioning the pulmonary and pleural complications. He detailed several case reports. In order to combat an ascending meningitis after laminectomy, Klapp[91] advises venous stasis (Bier's method) and repeated lumbar puncture. Believing that the cause of death in the majority of cases of cord injury is due to pyelonephritis Schum[92] recommends cystostomy, Goldberg[93] advises administration of urinary antiseptics from the time of injury and, in retention, regular catheterization.

The Paris thesis by Saloff[94] has for its theme *camptocormia*. This is a term used by Souques to designate an abnormal functional posture assuming the form of a more or less permanent flexion of the trunk on the hips with extension of the head. It is due to muscular contraction (not contracture) chiefly affecting the abdominal muscles, the lumbar portion of the erector spinae and occasionally the psoas. In the supine position the faculty posture corrects itself spontaneously on a resisting surface. There are no accompaning organic lesions. The condition occurs in predisposed persons frequently under war conditions and is cured by suggestion. The thesis contains histories of eighteen illustrative cases. A series of spinal cases somewhat similar to the foregoing is described and pictured by Redard[95] in a series of photographs. The attitude resembles that of a man trying to touch the floor with his finger tips. Psychotherapy is a useful aid in addition to physical therapy, but forcible correction is warned against. The organic cases are usually rebellious to treatment. The condition is curable.

Trench spine is classified as neurasthenia by Campbell.[96] The pain and paralysis are attributed to displacement of the cerebrospinal fluid and a residual disturbance of the lower spinal segments.

Oliver and Winfield[97] record remarkable low temperatures in a patient presenting a quadriplegia of flaccid type due to a cord injury opposite the sixth cervical spine. By means of a low registering thermometer the rectal temperature, on one occasion, fell as low as 80 F.

Operative Indications and Prognosis

The subject of operative indications depends so largely on a correct neurological diagnosis and on a proper conception of underlying pathologic conditions that some mention would here appear desirable, although it is not properly included in the scope of this review. There have been repeated references, on the one hand, to spontaneous recoveries or marked improvement in severe concussion paralyses, and on the other hand, to the grave distal lesions in both cases of direct injury and of direct concussion. Further, complete and partial lesions of the cord may present similar clinical pictures.

These considerations have made a number of writers incline to conservatism in regard to operative treatment in doubtful cases, as they hesitate to subject a patient to a laminectomy without reasonable hope of benefit. Guides would appear to be: (1) The nature of the injury; (2) the probable character of the lesion; (3) clinical experiences with the course of these injuries, and (4) especially a thorough neurological examination, for the roentgen-ray examination is not always satisfactory even in cases of frank spinal injury. The general state of the patient and a consideration of existing complications are important. The prognosis of cord injuries is relatively grave both as to life and complete recovery. In an experience at the front, Guillian and Barré[98] report a mortality of over 80 per cent. in 100 cases of spinal cord injuries. In their experience the lesions are most often due to shell fire. Most patients did not survive three weeks. Pulmonary and urinary infections cannot be held accountable, rather is this high mortality due to one or the other of the following conditions: purulent meningitis; progressive cachexia, or disturbance of the sympathetic nervous system of the digestive tract, abdominal viscera or vascular glands.

Von Eiselberg[99] in a report to the second German Surgical Congress stated that he had operated in forty cases of gunshot injuries to the cord. In this series there were nine deaths and twenty-four improved cases. In a series of seventy-three nonoperative cases there were thirty-six deaths and thirty-five improved cases. These statistics are in favor of the operative cases, notwithstanding the fact that they were more severe and showed no spontaneous improvement. Except in cases where bone fragments or projectiles can be recognized he has made it a practice not to operate until eight or ten weeks after injury.

In an article reporting thirty-five cases of gunshot wounds of the spinal cord, Ascher and Licen[100] relied mostly on the neurological diagnosis to guide them in their operative treatment. The neurological findings located the injury somewhat higher than actually found. In twelve cases operation was considered contraindicated. The mortality was 25 per cent. Perthes,[101] in a report of six cases in which the projectile remained in the spinal canal, observed marked improvement in two cases following operation. He believed that laminectomy should be performed only in cases of partial cord section, but emphasizes the fact that there may be clinical signs of complete section when anatomically a part of the cord is preserved. In partial section an operation should be performed at once.

A study by Marburg[102] is devoted to a consideration of grave lesions of the cord which manifest little or no tendency toward

recovery. The pathologic condition underlying these states may be different yet present similar clinical pictures. Thusly, contusion, compression, softening or edema may stimulate total cord section. Especially does the author lay stress on the frequency of circumscribed post-traumatic arachnoiditis simulating complete cord section. He reports such a condition in a Russian soldier benefited by an operation to the extent that he was able to walk again with support.

Marburg and Ranzi[103] take the position that operation should be delayed until the spinal lesions are stationary. Pulmonary, abdominal, and renal complications (ascending pyelitis) are operative contraindications.

Spinal shock may simulate complete transverse lesion of the cord and Leva,[104] in a total of nine cases of this character, noted three practical recoveries with the exception of increased reflexes. Roussy and Cornil[105] in an analysis of five cases representing different types of paralysis report marked improvement even in severe quadriplegic forms.

In the Berlin Society of Neurology and Psychiatry (session of Jan. 11, 1915), Borchard[106] reported two cases of apparent total cord section in which, although the dura was intact, the cord was profoundly damaged. Hennenberg demonstrated a cord specimen of similar character with intact dura. The cord was the seat of a considerable degeneration consisting of necrosis, numerous granule cells and neurologia reaction. Rothmann believed that these histologic changes were contraindications against operation and that operation should not be done in every case of spinal paraplegia.

Lewandowsky[107] takes an extremely conservative position in regard to operative intervention. He maintains that operation is nearly always contraindicated, as it is useless in total cord section and partial ones do better without operation. The injuries which improve are those due to traumatic necrosis and hemorrhage and not to laceration. In contrast to the foregoing, some surgeons take a radical view in regard to operative measures. Hull,[108] for instance, believes that harm may be done by delay because of sepsis or compression. In a material of twenty-five operative cases Fragenheim[109] reports six deaths. Fragenheim asserts that contusion of the cord, compression of the cord and complete transverse severance may give the same clinical picture with loss of control of bladder and rectum. It is difficult to demonstrate with the roentgen ray, projectiles or bone fragments compressing the cord, so the author advises exploratory laminectomy in all cases. Goldstein[110] reports a case in which the symptoms of complete cord section had existed for a long period. An operation was followed immediately by amelioration of symptoms. He believes that

adhesive traumatic meningitis as well as osseus compression can simulate total section symptoms and inclines to the side of operative treatment even though at times no benefit may result. Armour[111] believes in surgical interference when there is incomplete section and the patient is in fair condition. He protests against undue operative delay.

Gray[112] gives the following indications for operation at a casualty clearing station:

1. In the presence of incomplete paralysis of motion or sensation below the lesion, especially.

2. If the roentgen ray shows displaced fragments of bone or the presence of a piece of metal in or near the cord.

3. When the symptoms of paralysis have developed after the infliction of the injury, unless due to inflammation in patients who have been "lying out" when operation is practically hopeless.

4. When pain, due to pressure on nerve roots, is excessive and uncontrollable.

5. In very exceptionable cases, when the character of the wound is such that sepsis, although not already evident, is likely to develop and cause rapid death. In all other cases it is better, when feasible, that the patient should be evacuated.

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Abstracts from Current Literature

A CONTRIBUTION TO THE STUDY OF THE PATHOLOGY OF HUMAN AND EXPERIMENTAL POLIOMYELITIS, BASED ON CASES OCCURRING DURING THE EPIDEMIC OF 1916 IN NEW YORK CITY. HUBERT S. HOWE, A.M., M.D., J. Nerv. & Ment. Dis., **48**: Nos. 2 and 3, 1918.

The author records in considerable detail the findings in sixteen cases of human poliomyelitis and in seven monkeys experimentally infected. His histologic methods are varied and his descriptions of the lesions are fairly complete and give a very good account of the types of changes which are to be encountered in acute cases. No new lesions are recorded. The reactive cells are grouped in general into five classes, namely, lymphocytes, polyblasts, ameboid neuroglia cells, plasma cells and polymorphonuclear leukocytes, and the author remarks on lack of any uniformity in the proportion of these various groups to be found not only in different cases but in different areas of the same case. No clinical data such as the duration of life after the onset of the disease, or the extent of the paralytic involvement, nor the relative severity of the attack are recorded. When one studies poliomyelitis material from patients who have succumbed late in the course of the attack after the more acute symptoms have disappeared or have begun to subside, the polymorphonuclear leukocytes are strikingly few in number and the lymphocytes predominate, and the suggestion has been made that the polymorphonuclear cells are only called out in numbers by the early stages of the disease process and rapidly give way to the lymphocytes. So striking is this tendency that material from patients who die from one to two weeks after the onset of paralysis rarely show the polymorphonuclear infiltration at all.

In discussing the histologic picture of cells undergoing destruction the author notes a marked variation in the mode of disintegration, and while conceding that these may be phases of a common disintegrative process he seems to lean toward the hypothesis that they may represent the effect of different pathologic moments. In this connection we must bear in mind not only the temporal relation as expressed in the term phase of disintegrative process, but also the differences in intensity of the destructive factor. Because of the relative selective affinity of poliomyelitis for the anterior horn cells we must postulate a lower degree of resistance for this group of cells, and it seems only logical that the individual resistance of given cells within this group must also vary. Again, in dealing with a bacterial or living virus disease the probabilities are that the dosage of virus received by different cells even in the same nuclear group will vary within wide limits depending on the ease of access from the transmitting medium—blood or lymph or mesodermal tissue as the case may be. If we grant differences both in individual resistance of cells and in the severity of the invasion as well as in the stage or phase at which it is observed, the hypothecation of different pathologic moments seems unnecessary. A quite parallel condition is often seen in other processes leading to nerve cell destruction. Thus, it is not unusual to encounter in the same brain in paresis examples of chromatolysis, neuronophagia, Nissl's *Schwerezellerkrankung*, axonal reactions and even cell sclerosis.

One of the author's groups of degenerative alterations in the neurocytes is that of single and multiple vacuolization. In his illustrative photomicrographs vacuoles can be seen in the gray matter quite similar in type to those within the cells, and the whole picture is very suggestive of the artefacts not infrequently seen in embedded specimens. The reviewer has encountered difficulty with this type of vacuole. It occurs frequently in paraffin and less frequently in celloidin material, and has been tentatively explained as a result of the too rapid evaporation of the ether, xylol, or chloroform used in the embedding processes. Vacuoles of this type must be looked on with suspicion unless they can be demonstrated in sections cut on the freezing microtome as well as by the embedding methods.

ORTON, Philadelphia.

IRRIGATION OF THE SUBARACHNOID SPACE. L. B. ALFORD, M.D., J. Nerv. & Ment. Dis. **48**:359 (November), 1918.

In a series of interesting experiments carried out in cats and on human cadaver, Alford showed that it is possible to pass solutions from one extremity of the subarachnoid space to the other, providing suitable technic has been employed.

In the case of animals, solutions were passed from the spinal subarachnoid space out through a cranial trephine opening, in the opposite direction and from a lateral ventricle through the spinal subarachnoid space. In the case of the cadaver, in addition, solutions were passed from the lumbar region of the spine out through a needle inserted into a lateral ventricle.

In animals the solutions came in contact with practically all of the surface of the central nervous system, whatever the procedure. With the cadaver, however, the base and only a limited part of the convexity—that in the neighborhood of the trephine opening—are touched. In ventricular irrigations on the cadaver, whether ascending or descending, only the basal and medullary regions come in contact with the solution.

The followng antiseptic solutions were successfully used in the irrigations on animals: formalin (neutral), 0.5-0.25 per cent.; boric acid, 3 per cent.; potassium permanganate, 1:2,500; lysol, 1:300; argyrol, 1 per cent. Potassium iodid, 3 per cent.; hydrogen peroxid, 10 per cent., and perchlorid of mercury 1:10,000 were toxic.

Alford believes that this procedure offers a useful method of investigating the action of drugs in the meningeal spaces and perhaps of studying the physiology of the cerebrospinal fluid.

It is a question, however, whether this procedure can be applied in human therapeusis, no matter how desirable it may seem experimentally. As the author wisely puts it, however, in desperate conditions in which little can be done otherwise, and in which almost any risk is justifiable such as septic, pneumococcus or tuberculous meningitis, this method may be attempted.

WEISENBURG, Philadelphia.

PITUITARY DISTURBANCE IN ITS RELATION TO THE PSYCHOSIS OF ADOLESCENCE. BEVERLEY TUCKER, M.D., J. A. M. A. **71**:330, 1918.

Studies of psychoses which are more or less clearly related to hyposecretions and hypersecretions of endocrine glands are, of course, what every one is waiting for anxiously. But it is hoped that more and more the psychiatric analyses in these studies will be painstaking and up to the standard of modern psychiatry, so that it will become possible gradually to compare mental reac-

tion types ascribed to endocrine disturbance with other reaction types in which we have no evidence of such a relationship. Such analyses will by no means be easy, but modern psychiatry is quite far enough to attempt them; at any rate it seems that a psychiatrist should at least show that he appreciates this foremost psychiatric demand. In the present paper no attempt has been made in this direction. While the physical descriptions are very good, the psychiatric portion is quite superficial. On account of the importance of the matter we shall, however, in the following give what there is, leaving out entirely the author's general introduction on the functions of the pituitary, etc., as well as what seems to the reviewer the convincing proof that the endocrine situation is what Tucker claims it to be.

1. Cases with evidence of preadolescent hyperpituitarism with apparent increased hypersecretion during adolescence. He gives two cases.

(*a*) Woman seen at 26. At 12½ she was hypersensitive, had "night rigors," wondered what people would look like if dead, had "transient hallucinations." loss of affection for her mother and sudden changes from gaiety to solemn intenseness.

(*b*) Girl seen at 15½. After a spell of homesickness at 14½, baby talk, hysterical seizures, writing up and down on paper instead of across, tantrums, loss of affection for her mother, imaginary telephone conversations, playing imaginary baseball, infatuations for various men and women, persecutory ideas. All these symptoms gradually disappeared and she is normal at 19.

2. Cases with evidence of preadolescent hypersecretion with apparent marked decrease of the secretion during adolescence. He gives one case.

Girl seen at 15. At 14½, after a fever, she had trance states in which she refused food, sighed deeply and would not talk. These lasted for days with sudden clearing up. No delusions or hallucinations and no loss of affection for the family. She recovered in three months after administrations of anterior lobe extract.

3. Cases with evidence of normal preadolescent secretion but adolescent decrease of pituitary secretion. Two cases.

(*a*) Boy seen at 14. At 13 psychosis began. He would repeat many acts—for example, he would walk up and down the front steps thirteen or fourteen times before going to school, cross and uncross his knees until stopped, etc. He could not concentrate enough to write a postal card, could not dress himself, was excitable, irritable, would make grimaces, suddenly jump up and whirl about. "The thought processes were slow." There were no definite delusions or hallucinations. He gradually returned to normal on whole gland pituitary extract.

(*b*) Woman seen at 18. Her psychosis began at 16. She became dull at school, showed poor memory, had hallucinations of faces peeping at her, and heard voices. She became indolent, unaffectionate and indifferent, and could not concentrate in writing. She was obstinate and appeared wrapped up in her thoughts. Recovered on whole pituitary gland feeding in three months.

4. Preadolescent decrease of pituitary secretion with evidence of further decrease shown in adolescence. One case.

Boy seen at 15. At 14½ he had an epileptoid convulsion. Later two others. He developed loss of ambition, was inattentive, lazy, obstinate, showed lack of emotion, irritability, *wanderlust* (at one time he was away for many weeks). Recovered in less than a year on whole pituitary gland feeding.

Hoch, Santa Barbara, Calif.

A NEW PLEURIGLANDULAR COMPENSATORY SYNDROME. WALTER TIMME, M.D., Endocrinology, July-September, 1918.

Under this title, Timme describes a series of cases which form a distinct clinical entity with a definite symptom complex, the basis of which is a thymus-adrenal-pituitary syndrome with the pituitary gland playing the main rôle in the compensation effected. The syndrome begins in the preadolescent period and passes through its various stages in about two decades.

The leading and outstanding symptom in these cases, is great muscular fatigability, and associated with this, a history of recent or concurrent rapid growth and headaches referred to the frontal region and midway between the temples; low blood pressure, and low sugar content of the blood, are characteristic clinical signs during the whole course of the disorder until the final stage, when the pituitary gland may by its compensatory hyperactivity have effected a clinical cure.

Beginning in early youth, a case presents in its incipiency, largely the characteristics of status thymo-lymphaticus, or status hypoplasticus of Bartels. There is the complaint of muscular fatigability, and there is usually present the white line of adrenal insufficiency of Sargent. Enuresis is common, the genital development is retarded and in the male there is scrotal implantation of the penis, or cryptorchism or both, the joints are usually hyperextensile and the ligaments relaxed, the skeleton shows abnormal proportioning, teeth are usually delayed in their appearance, the lateral incisors (especially in girls) and the canines are frequently greatly underdeveloped.

At the age of puberty the second stage is reached, the genitalia are retarded in their development, the pubic and axillary hair are sparse, and in the male the pubic hair has the feminine horizontal distribution. Extremely rapid and abnormal growth in length now begins, 5 or 6 inches a year, and the fatigability increases. This rapid growth is ascribed to the lack of gonadal inhibition of growth. The thymus as seen by the roentgen ray is enlarged. A roentgenogram of the skull at this stage shows an abnormally small sella turcica, or a sella bridged over by the clinoid processes hemming in the pituitary. On the capacity of the pituitary to become hyperplastic, and of the sella turcica to accommodate the enlarging pituitary, depends, according to Timme, the further course of the disorder.

At about the 20th year the third stage is reached and the results of the compensatory hyperaction of the pituitary are seen. Growth has continued until the patient is 6 feet or more, enlargement of the hands and feet are noticed, and as the pituitary enlarges the patient suffers from characteristically localized headache, situated anteriorly and between the temples; he is decidedly vagotonic and a roentgenogram of the sella now shows erosion of the clinoids and deepening of the cavity; the blood sugar and blood pressure begin to rise.

In the final stage, three to ten years later, if complete compensation has taken place, there are acromegalic manifestations grafted on the earlier manifestations of a thymic stage, but the blood sugar and blood pressure are now normal and the headaches have disappeared.

In uncompensated cases the sella remains small and bridged, headaches and muscular fatigability continue, attacks of petit or grand mal supervene, there is mental hebetude, and increase of weight occurs, and the cases merge into a dyspituitary syndrome.

Timme incidently calls attention to the emotional instability and frequent moral and sexual obliquities of hypopituitarics and their tendency to phobias

and compulsions. In discussing the pathogenesis he remarks that status hypoplasticus, which is the clinical picture dominating the first stage, has been variously attributed to adrenal, gonadal and pituitary hypofunction, the thymus alone being supposedly hyperactive. In these cases all these endocrine anomalies are present *ab initio*, and were not some corrective forthcoming the organism would come to early grief, and many patients do succumb early. The deficient adrenal-chromaffin system is to be credited with the great fatigability, the low blood sugar content, the low blood pressure and the white line. The pituitary gland is the critical factor which by becoming hyperplastic compensates, through its blood pressor and sugar mobilizing principles. Feeding these cases with fairly large doses of pituitary produces highly satisfactory improvement.

In the course of the disorder, other glands may be brought into the syndrome and alter the picture somewhat but have no great determining effect on the course of events, and once recognized in any of the early stages the further general progress of the case can be prognosticated with accuracy.

In connection with the rapid growth in the second stage when the pituitary is still small, the gonads undeveloped and the thymus enlarged, one recalls the experiments of Gudernatsch who by feeding tadpoles with thymus gland noted a great increase in their size without metamorphosis. There appears to be a definite relationship between the size of the thymus gland and the gonads. Henderson and Noel Paton noted in castrated cattle and guinea-pigs that the thymus gland was greatly enlarged; Klose and Vogt noted in thymectomized animals that the testicles and ovaries increased in size and that the growth of the animals was retarded. According to Falta the closure of the epiphyses, and hence definite cessation of growth, is brought about by the interstitial cells of the gonads.

F. DEL. MYERS, New York.

THE PATHOGENESIS OF DEFICIENCY DISEASE. ROBERT MCCARRISON, M.D., D.Sc., F.R.C.P., Brevet Lieut.-Col., I. M. S., Brit. M. J. **177:** (Feb. 15) 1919

The want of substances essential for the normal metabolism of the human or animal body suggests the need to examine the effects of their deficiency on the organs responsible for digestion and assimilation and for the regulation of metabolic processes The influence of deficiency of vitamins on the adrenal glands, on the pituitary gland, on the gonads, on the pancreas, on the liver and on the spleen is practically unknown; while that on the thyroid apparatus has been incompletely studied. The author invites attention to the effects of vitaminic deficiency not only on the central nervous system, but on the endocrinal apparatus.

Polyneuritis avium was produced in a large number of pigeons by a diet of polished rice, and the tissues of the birds were carefully studied postmortem. He concluded that the absence of certain accessory food factors from the dietary leads not only to functional and degenerative changes in the central nervous system, but to similar changes in every organ and tissue of the body. The morbid state to which their absence gives rise is not a neuritis.

The symptom-complex resulting from the absence of these substances is due (*a*) to chronic inanition; (*b*) to derangement of function of the organs of digestion and assimilation; (*c*) to disordered endocrine function; (*d*) to malnutrition of the nervous system, and (*e*) to hyperadrenalinemia.

Certain organs undergo hypertrophy — the adrenals; others atrophy — in order of severity, the thymus, the testicles, the spleen, the ovary, the pancreas, the heart, the liver, the kidneys, the stomach, the thyroid, and the brain. The pituitary gland showed a slight tendency to enlargement in adult male birds only.

The enlargement of the adrenals is a true hypertrophy, associated with a proportionate increase of the glands' adrenalin content. The quantity and quality of the adrenalin is approximately the same as that found in health.

Edema has invariably (100 per cent.) been associated with great hypertrophy of the adrenals; while 85 per cent. of all cases having great hypertrophy of these organs had edema in some form. In such cases the amount of adrenalin, as determined by physiologic methods, has been considerably in excess of that found in cases not presenting this symptom, and greatly in excess of that found in normal adrenals.

Inanition gives rise to a similar state of adrenal hypertrophy, and to a similar state of atrophy of other organs, the brain excepted.

The edema of inanition and of beri-beri is believed to be initiated by the increased intracapillary pressure which results from the increased production of adrenalin, acting in association with malnutrition of the tissues. Failure of the circulation and venous stasis may subsequently contribute to it. Age is an important factor determining its occurrence. This finding is held to account in great measure for the occurrence of "war edema" among prisoners of war in Germany.

Wet beri-beri and dry beri-beri are essentially the same disease; the former differs from the latter in the greater derangement of the adrenal glands.

Gastric, intestinal, biliary and pancreatic insufficiency are important consequences of a dietary too rich in starch and too poor in vitamins and other essential constituents of the food. Some of the obscure metabolic disorders of childhood might be examined from this viewpoint as well as from that of endocrine gland starvation.

A state of acidosis results from the absence of so-called "anti-neuritic vitamins"; this state is due to the imperfect metabolism of carbohydrates and to acid fermentation of starches in the intestinal tract. Clinically it is evidenced by progressive slowing and deepening of the respirations.

Great atrophy of muscular tissues results from deficiency of accessory food factors; it is due in part to the disturbance of carbohydrate metabolism in consequence of disordered endocrine function, in part to the action of the adrenals in supplying blood to the vegetative organs of the body at the expense of the muscles.

Profound atrophy of the reproductive organs is an important consequence of "vitaminic" deficiency. It leads to the cessation of the function of spermatogenesis.

The central nervous system atrophies little; paralytic symptoms, when they occur, are due mainly to impaired functional activity of nerve cells, much more rarely to their degeneration.

Because the thymus, the testicles, the ovaries and the spleen atrophy out of all proportion to other tissues, they possibly provide a reserve of accessory food factors for use on occasions of metabolic stress. This reserve, however, is rapidly exhausted.

The bones are thinned; there is loss of bone marrow; the red cells of the blood are diminished 20 per cent.; there seems to be nuclear starvation of all tissue cells. Even the adrenals, which alone of all the organs of the body undergo enlargement, show on section changes in some of their cells

indicative of nuclear starvation. Accessory food factors are nuclear nourishers. Though deficiency of certain accessory food factors is the essential etiologic agent in the genesis of beri-beri, infectious and parasitic agencies are often important causes determining the onset of symptoms. The deficiency renders the body very liable to be overrun by the rank growth of bacteria.

[Eykman, Sujuki, Funk, McCollum and Kennedy, and others have reported that continual feeding of birds with polished rice induces polyneuritis, in which there was degeneration of nerve cells; the latter is the specific result of the lack of the water soluble B vitamin.[1] The association of endocrinal and neural lesions is especially important, as Hart, Miller and McCollum[2] reported that in swine fed on wheat and grain mixtures that ensured nutritive deficiencies "no certain abnormal conditions were noted in the ductless glands," but there were marked changes in the spinal cord. McCollum and Pitz have also emphasized the association with dietary deficiency of the pathologic influence of micro-organisms inhibiting the alimentary tract.[3]]

ARMSTRONG, Katonah, N. Y.

A STUDY OF TWO EPILEPTOID CASES IN SOLDIERS. G. STANFORD READ, M.D., J. Abnorm. Psychol. **13**: pp. 32-41.

A thorough appreciation of mental factors entering into the causation and content of epileptic phenomena is relatively new. It represents an important addition to our knowledge even though we cannot as yet see clearly enough to harmonize the importance of physical and mental factors, both of which exist. The two cases in this paper bring some interesting data concerning the development and the psychology of epileptic phenomena.

CASE 1.—This patient is a man, aged 34. He is said to have a very egotistic outlook on life and to be superficially religious. He was greatly attached to his mother and had an unusually severe father, who thwarted and punished him unmercifully. His revolt against this severity was largely repressed. Twelve years before admission he quarreled with a friend in his own home, when his father, who was sick in another room, entered to separate them. Without realizing it, the patient struck his father in the face so that the latter's nose bled. Two days later the father died. After the father's death he was depressed for months and had returning dreams of seeing his father with a bleeding nose. Ever since the incident he has felt that if he saw his friend who was the cause of it all, he would kill him. A few months after the father's death there was another quarrel with a friend. He suddenly felt a weakness come over him, lost consciousness and was violent. This was his first fit. A few years after that another quarrel with the same result. In the army he was a band man. He was always resentful toward authority and when he felt that the bandmaster did not treat him right, and "on other matters coming to a head" he had three unconscious attacks with violence.

CASE 2.—A man, aged 45. This patient had always been a spoiled child, thwarted. He had violent fits of temper. When 16 he was found in the streets insufficiently clothed. At 19 he wanted to become a minister of the Church of England. Not allowed to do this by his Catholic parents, he felt it was the greatest disappointment of his life. Soon after that he developed a terrible temper. At 20, he was working in a mill. There one man bullied him.

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1. McCollum, Simmonds and Pitz: Jour. Biol. Chem. **25**:239, 1916.
2. Hart, Miller and McCollum: Ibid. **25**:239, 1916.
3. McCollum and Pitz: Ibid. **31**:241, 1919.

He only remembers that, after a special torment and after warning his persecutor, six or seven people pulled him off this man. Then he had a fit. After that, he had outbursts of temper with hazy recollection. His father's death was followed by a depression and insomnia lasting twelve months. About twelve years ago he went into partnership, found the partner to be a "bad lot," dissolved partnership, but was accused of embezzlement and sentenced to three months. This he claims was unjust and produced intense resentment against the world. Since then he has peculiar spells in which, according to Read, he tries to get square with the world. He is impelled to take a journey. He then calls at a home and books a bogus order, making the person pay a deposit on account (never more than 3 shillings). On return home his recollection is hazy. He has a feeling that he has done something wrong, but also a feeling of relief. For these things he is often arrested. Read also gives an interesting example of hallucinations which foretell the patient's later actions. The relatives give a history of very bad epileptic heredity. HOCH, Santa Barbara, Calif.

EPIDEMIC ENCEPHALITIS. S. A. KINNIER WILSON, Lancet **2**:7 (July 6) 1918.

A subject, as Kinnier Wilson says, very much a *l'ordre dujour* at the present is the occurrence in England of a relatively large number of cases which, according to their main features, fall into the general group of acute encephalitis or polioencephalitis and seem to have epidemic tendencies. All of these cases, as might be expected, do not conform to any one rigid type. The development of ophthalmoplegia in a number of them led to the suggestion that the etiologic factor was to be found in botulism, a postulate which proved somewhat alarming, especially in days when the food question was so acute.

Wilson considers it desirable to accumulate as much clinical and pathologic evidence as possible before indulging in generalizations, particularly when a comparatively rare nervous disease occurs in epidemic form. He feels that there is justification for asserting that such a nervous disease has been prevalent in England whose features are sufficiently indicative of encephalitis. It is characterized, in a large number of instances, by pathologic drowsiness amounting not infrequently to stupor. This predominant characteristic of the disease has not hitherto been noted by neurologists in poliomyelitis, either endemic or epidemic. Yet there is a resemblance which should be mentioned between this disease and certain aberrant forms of epidemic polioencephalitis. The weight of evidence, however, suggests that the epidemic encephalitis is not identical with polioencephalitis.

Out of thirteen cases, Wilson selects seven from his personal experience exemplifying various types of the disease, varying either in severity or in localizing symptomatology. The following types have been recognized in actual cases:

1. The acute and fatal type with mainly mesencephalic localization.
2. Severe and fatal type with meningeal symptoms.
3. Mild recovering type.
4. Ponto-medullary superior and inferior type.
5. Severe type with prominent mental symptoms.
6. Cortical type with lethargy, catatonia and mental symptoms.
7. Paralysis agitans type with localization in the regio subthalamica.

Epidemic encephalitis is an acute nervous disease characterized by both general and localizing symptoms; in minority of cases the latter are not prominent. The sexes are about equally affected and there is no special age incidence, infants, children and adults alike being stricken. The onset is relatively acute, the disease being usually established within a few days, occasionally, however, it begins in a fulminating manner.

General Symptoms: These comprise apathy, lethargy, drowsiness, pathologic sleepiness, stupor, absence of initiative and spontaneity, the latter being particularly prominent. Sometimes the lethargy disappears later during the illness; occasionally it is not a noticeable feature.

A certain degree of restlessness or restless delirium with a reduction of mental activity to the level of automatism is quite common. In some cases there is some acute mania, alternating with profound indifference. Catatonia or flexibilitas cerea is a frequent symptom. Illusions and hallucinations, as in any toxic psychosis, have been noted. One case presented a typical *Witzelsucht.* Headache, giddiness and violent vomiting may occur. Apparently epileptiform attacks, properly so-called, are not observed. The temperature is often more or less normal throughout the entire course, or it may rise moderately at the beginning or during the illness. In fatal cases it is sometimes increased progressively but irregularly, after the mode of tuberculous meningitis. In a certain percentage of cases, as in a number reported by Economo and Wilson, meningeal symptoms are present. In these instances there is stiffness of the neck and Kernig's sign, but as a rule, neither of these is well marked and never as prominent as in the typical acute meningitis.

Localizing Symptoms: The commonest of all localizing symptoms is that of the general group of superior poliomyelitis, namely, a peri-aqueductal grouping. Most conspicuous among these symptoms is the paralysis of accommodation and corresponding indistinctness of vision or diplopia, the latter being a frequent early symptom. In addition, a certain degree of ophthalmoplegia externa and interna with ptosis may be found which is symmetrical or asymmetrical, complete or incomplete. The pupils may be contracted or dilated, fixed or normal. It should be borne in mind that the patient may have the appearance of mere drowsiness, due to bilateral ptosis, although there is no paralysis. Inability to sustain ocular movement my be the only defect.

The lower cranial nerves to a variable extent form the next most common type of nuclear invasion. The facies is often expressionless due to the bilateral obliteration of the facial lines. There is a distinct predilection for the affection of motor as opposed to sensory cranial nerve nuclei, which seems to indicate a specificity of action in the postulated virus of the disease.

Rarely the limbs are involved. When this occurs, the indications point to a cortical, subcortical, mesencephalic or pontine invasion of the corticospinal paths and not to a cord invasion. This is shown by the absence of wasting and by the conservation of the tendon reflexes as well as by the occasional occurrence of the extensor plantar response. Sensory symptoms are insignificant or absent.

Investigation of the Spinal Fluid: The cerebrospinal fluid in almost all recorded cases has given consistently negative results. No authenticated organism has been detected and cultures from the fluid have remained uniformly negative. Chemically and microscopically, the fluid shows no departure from normal. Pleocytosis is rare and not limited to the lymphocytic type. Wilson regards it as distinctly curious that the fluid shows, in the average case, so

little that is abnormal, particularly in view of the perivascular cellular infiltration usually found on microscopic examination of the nevous system.

Pathologic: From the findings of Wilson's two fatal cases, there is a close resemblance to the details given by Economo and by Netter. Microscopically, there is little on the cranial surfaces beyond meningeal congestion and perhaps a minor amount of patchy localized meningitis. There may also be limited areas of subpial hemorrhagic effusion and hemorrhagic foci. Microscopically, both gray and white matter is the seat of minute hemorrhagic areas scattered irregularly and occasionally massed in a confluent manner. The pathologic condition is essentially diffuse and variable in distribution, for there seems to be little doubt that the regio subthalamica, the neighborhood of the third ventricle and iter, the mesencephalon in general and the motor cranial nerves of the pons and medulla are most frequently the seat of the lesion. The meninges are always affected to a greater or less extent and particularly the pia mater. There is scattered cellular exudate or vascular congestion with perivascular cellular infiltrate. The cells are by no means only, or even mainly, lymphocytic; polymorphonuclear as well as plasma cells may be found. The portions of the brain already mentioned may likewise show an obvious perivascular cellular infiltration which is especially noticeable along the veins. This is of varying extent and the blood vessel walls themselves are unchanged. Parenchymatous alterations of nerve cells such as degeneration, acute and subacute, and actual neuronophagia just as in poliomyelitis, may be seen here and there. Ameboid glia cells or nuclei are occasionally found around nerve cells in a condition of early change. The white matter is generally unaffected but may show secondary alterations. Minor changes of the above general nature may be found in the spinal cord.

Duration of the Disease: In typical cases the duration is variable. It may end fatally in a few days or it may be prolonged for weeks and months. It is doubtful whether there is a complete restitution in all recovered cases. The pupillary and ocular motor muscles are especially sluggish in their return to normal. Netter has noted in recovered cases that defects of accommodation may persist for a long time. Economo's figures of the ratio of mortality are six cases out of eleven, Netter's seven out of fifteen, and Wilson's two out of thirteen.

Nature of the Disease: Clinical and pathologic evidence points clearly in the direction of an encephalitis amounting usually to a hemorrhagic encephalitis of toxic or toxi-infective origin. In all reported cases the cerebrospinal fluid has been bacteriologically negative. No recognizable organism has been detected in the tissues on microscopic examination. In one case reported by Economo, which ran a rapidly fatal course, an emulsion of the brain and spinal cord was injected subdurally into a *Macacus rhesus* by Von Wiesner. The experiment animal died in forty-six hours, having presented the symptoms of profound stupor at least twenty-four hours previous to death, in addition to which there was a paresis of the right hind limb. On examination of the brain, Von Wiesner discovered an acute hemorrhagic encephalitis and recovered a gram-positive diplostreptococcus which he was able to cultivate. Culture of this injected into apes produced somnolence with muscular weakness, while peritoneal injection into guinea-pigs caused death from internal hemorrhage. It is important to note, however, that a filtrate from the original brain-cord emulsion of the patient through a Berkefeld filter when injected into a Macac monkey produced no symptoms. Von Wiesner further states that from all human cases the material of which he was able to avail himself, he succeeded in growing this organism. In view of the unsatisfactory nature of Von Wiesner's conclusions, the question whether this diplostrepto-

coccus is a specific cause of the disease must be left open. The negative bacteriologic findings in the tissues of Wilson's two fatal cases militate against the acceptance of the somewhat summary statement of Von Wiesner's communication. Wilson himself, however, believes that epidemic encephalitis differs from the common type of sporadic polioencephalitis in the following details:

1. The lethargic element so strikingly manifest in epidemic encephalitis is largely wanting in ordinary cases of polioencephalomyelitis.

2. Lethargic encephalitis, that is the epidemic form, occurs in winter and spring; poliomyelitis in epidemic form is essentially a disease of the summer and autumn.

3. Epidemic encephalitis is showing a greater percentage of incidence among adults than has occurred in epidemic poliomyelitis.

4. The significant and minor changes in the spinal fluid are not consistent with what is constantly found in acute cases of ordinary poliomyelitis.

5. Meningeal symptoms are more common in poliomyelitis than in the present epidemic encephalitis.

6. The perivascular cellular infiltration in epidemic encephalitis is less intense than in poliomyelitis.

7. If, as has been suggested by Prof. F. W. Andrewes, the present epidemic is merely one of aberrant polioencephalomyelitis, it is strange that only aberrant cases seem to be occurring.

8. The hemorrhagic element is proportionately more prominent than in epidemics of polioencephalomyelitis.

9. So far as Wilson is able to ascertain, no family cases have occurred in the present epidemic, while such are far from infrequent in the ordinary poliomyelitis, epidemic or otherwise.

The evidence now available suggests that the present epidemic is a form of infection akin, no doubt, to the virus of poliomyelitis but not identical with it.

An epidemic of cases apparently analogous to those under consideration occurred in Vienna in 1917 and was the subject of a painstaking description found in the papers of Economo. This author coined the term *Encephalitis Lethargica* for the disease. Netter in Paris, during the spring of 1918, observed a similar epidemic for which he adopted the name *Encephalite Lethargique Epidemique*. Wilson very poignantly points out the inconsistency of the term Encephalitis Lethargica, for it is the patient who is lethargic and not the encephalitis. He prefers the term *Epidemic Encephalitis*.

Economo calls attention to the mysterious "Nona," an epidemic which took place in Italy and Hungary in the spring of 1890. A full review of this question was published by Longuet in 1892. The contention was then advanced, apropos of Nona, that the cause of the pathologic sleep frequently noted in that affection was the incidence of the morbid process in the gray matter of the iter and anterior part of the floor of the fourth ventricle. Sleep physiologic and pathologic was thus localized in these important structures. Wilson believes there is more to support this interesting contention than may appear at first sight. Reference may also be made to a valuable paper by Breinl, describing a "mysterious disease" which occurred in Queensland in New South Wales in 1917, and which had an alarming mortality. Wilson concludes that there is unquestionably at present an excellent opportunity for solving the problem concerning the cause of encephalitis and thereby of clearing up much that has been obscure in our knowledge concerning this disease

TILNEY, New York.

DISSOCIATION OF VISUAL PERCEPTIONS DUE TO OCCIPITAL INJURIES WITH ESPECIAL REFERENCE TO APPRECIATION OF MOVEMENT. GEORGE RIDDOCK, M.D., Brain **40**:15, Part 1, 1917.

Although the fact that there resides in the calcarine cortex a dual function since movement and object vision has been known and appreciated for some time, yet the presentation of the subject by Riddock serves to crystallize our ideas in this matter. The article which is based entirely on injuries consequent on the World War is admirably clear and convincing. Perhaps its preeminent value is represented by the information afforded by this dissociation in the realm of prognosis and in this we have a distinct and valuable contribution to our knowledge of the subject. The paper is based on wounds of all types, rifle, machine-gun and shrapnel bullets, fragments of high explosive and bomb-shell casing complicated, in many cases by in-driven pieces of bone and infection. The inclusion in the report, of one case of loss of stereoscopic vision with retention of the actual ability to see, recognize objects, understand their proper use and memory retention of the object brings vividly to mind cases of somatic disturbance in which all types of sensation are intact and yet in which tactile recognition of the object is impossible. This case seems to indicate the existence of a cortical area, the intrinsic property of which is stereoscopic vision and emphasizes the fact that this quality of vision is not a pure corollary of binocular vision, as has been heretofore believed.

The author, however, draws one artificial distinction, implying a lack of analogy between somatic and visual sensibility on account of the absence of immediate contact in the case of vision between the source of the stimulation and the sensitive receiving apparatus; whereas, in reality the stimulation of the retina by means of the waves of energy set up in the ether by the reflection of waves of light from the object seen brings to bear as direct a stimulation as do friction waves in tactile thermic or pressure sensibilities.

In Chapter 1 the author discusses general, underlying principles and his deductions from the extensive study which he has made of the subject and draws the following conclusions:

1. Movement may be recognized as a special visual perception.
2. Appreciation of movement returns before the object as such is recognized, if recovery of vision is occurring.
3. Recovery of vision for movement begins in the peripheral field.
4. Charts of the fields of appreciation of the fields of movement are valuable in prognosis.
5. The dissociations of visual perceptions are analogous to those found in disturbances of somatic sensibility in cases of cerebral injury.

Vision in large part can be viewed as a highly specialized and modified type of general sensation, subject to the same laws and dissociable into component elements. Our vision is the product of a synthesis between movement and object vision—the former being a more generalized sensation similar to the nondiscriminative type of general somatic sensation, the latter a more highly differentiated and specialized type analogous to the discriminative type of general sensibility. In addition, we are able to further differentiate a synthetic product of vision, namely, the appreciation of form or stereoscopic vision which is similar in character to the synthetic product of general somatic sensibility—stereognosis.

The tests were carried out by means of the rough finger test, verified and amplified by examination with the Hardy perimeter and the Bjerrum screen.

The same results were obtained by using squares or circles 1 cm. or 15 cm. in diameter. At the periphery of the dissociated fields, a blending was observed where movement and object vision pass one into the other very similar to our intermediate regions where nondiscriminative and discriminative tactile sensibility shade into one another.

In Chapter 2, which has the caption "Dissociation Between Appreciation of Movement and Recognition of the Object," are grouped ten cases which fall into three subdivisions.

GROUP 1.—*Showing only perception of movement in the affected field in addition to some perception of light.*—This group represented cases in which there was a complete dissociation over a greater or lesser field in which the appreciation of movement was retained, but with complete loss of object vision. In this group there was also included a case which demonstrated the return of movement vision to a considerable extent, with but little improvement of object vision, showing that the dissociation may be the immediate result of the injury or that it may be the late result of efforts toward reparation on the part of the cortex. The recovery of movement vision seems often to begin in the periphery occasionally as isolated area which may or may not later become linked up with the vision area retained at the time of the injury.

GROUP 2.—*Showing recovery of both perceptions though in different degree.*—In this group there are four cases presented:

1. Dissociation and partial recovery of vision for object and movement stimuli in complete homonymous hemianopsia.
2. The same phenomena in altitudinal hemianopsia.
3. The same phenomena in concentric contraction of the fields.
4. The same phenomena in quadrantic hemianopsia.

The first case presented a recovery of vision for movement which antedated the recovery of vision for objects and the extent of improvement of the former at all times during the diminution of the visual disturbance exceeded the latter. The eventual outcome was a paracentral scotoma which through improvement at the periphery suffered a progressive concentric reduction. This residual scotoma reached the point of fixation at one point in the lower part of the field.

The second case presented complete initial blindness which gradually contracted until the final residuum consisted of a central scotoma in the peripheral portion of which there was appreciation of movement, but in its central portion it was absolute for both movement and object vision.

The third case represented the gradual extension of visual fields which were at first limited to the macular region, object vision occupying the very center of this region and movement vision the outlying fringe. A gradual reduction of the area of vision and other manifestations indicated a secondary operation, after which the improvement of vision proceeded gradually and symmetrically, the field for movement vision always anticipating the field for object vision.

The fourth case presented a quadrantic defect similar in dissociation to the preceding in which the field for movement was always greater than the field for objects and in which the same relative concentric reduction took place.

GROUP 3.—*Where no dissociation or recovery of vision occurs.*—According to Riddock's work, it was infrequent to find cases evidencing no tendency toward recovery and although he has no pathologic evidence on which to base his conclusions, he postulates, in these cases, a lesion subcortical in location.

In summarizing these cases, the author emphasizes these points:

1. In recovery in cases of restricted visual fields, the first sign of returning vision is a beginning appreciation of movement.

2. This return always begins at the periphery of the visual field.

3. Whenever improvement takes place, there is always present a dissociation between the perceptions of movement and object vision, the field for the former always being the larger field.

4. This dissociation and its extent are valuable in prognosis.

5. The size of the field is the same, whether tested with white or black objects and whether tested with a 1 cm. or 15 cm. object.

Chapter 3, on *visual orientation and stereoscopic recognition*, is devoted to the consideration of the properties of stereoscopic vision and the evidence that it does not entirely depend on the integrity of binocular vision, but that, in addition, there is a cortical area similar to the stereognostic area in somesthetic sensibility in which resides the faculty of appreciating visual form and depth. The following defects can be summarized:

1. Inability to localize objects—only extremes being appreciated.

2. Inability to compare distances.

3. Inability to appreciate depth and thickness.

These defects were associated with defective tactile localization on the first three fingers, a loss of deep tendon and joint sense, and an interference with the appreciation of the thickness of an object.

Chapter 4 is composed of a careful consideration of the *location of the wounds* and *the defects* as seen on the operating table.

The author from the study of this material has reached the following conclusions:

1. The macular vision-center is situated in the polar portion of each occipital lobe. The retention of macular vision, that is, a failure of the hemianopic line to pass through the line of visual fixation is dependent on sparing of the occipital pole by the morbid process, indicating that the cortical representation of macular vision resides in the occipital pole and is not bilaterally situated for each eye.

2. The superior quadrants of the retina are represented in the upper part of the visual area and the lower quadrants in the lower part of the visual area.

3. The periphery of the retina receives stimuli which then travel to the anterior part of the area striata.

RILEY, New York.

THE MENTAL FACTOR IN THE NEUROSES OF WAR. R. G. GORDON, M.D., Seale Hayne Neurological Studies, **1**: No. 2.

The article is characterized by a considerable use of psychoanalytic concepts presented in a form in which neither the analytic color is vivid nor the notions clearly defined. Gordon's first point involves, under the demands of "common sense," the relations of patient and physician, to which he imputes, when properly arranged, much of a therapeutic advantage. Particularly in the hysterias the results are readily gained "through persuasion" based on an effective relationship of this order. It seems to emphasize a conclusion that his modes of "persuasion and suggestion" in the treatment of the hysterics depend largely on what is little else than that, termed in current phrase, "transference."

For two other groups, designated by him as neurasthenia and psychasthenia, he employs what is called "mental orthopedics." Neurasthenia is defined as "extreme fatigability with various physical symptoms due to exhaustion and not dependent on any organic abnormality." Psychasthenia, as compared to this, is a condition in which the adaptation to reality is effected. How far both of these definitions reveal an inadequacy is expanded in his notions of mental orthopedics.

This appears to rest on a preliminary analysis to discover in what direction the patient has gone astray and in what manner the mental processes may be rearranged and properly deflected into healthy channels. He frankly states the source of these notions as freudian, but with many protests of nonorthodoxy. He chooses, for instance, to pursue MacDougal to the thoroughly freudian notion of the direction of complexes by instincts and in complexes notes the chief director of conscious effort. His concept of the unconscious differs only in name, while his notion of conflict appears totally familiar. It is on this latter that the general structure of the symptom is based, in the treatment of which he brings out the old energic concept of a liberation of energy by a solution of the conflict brought about through the physician. It appears as though many of these conflicts are in considerable part conscious, while the unconscious conflicts are usually of a kind where the "merest scratch is sufficient to lay bare" the unconscious material. Following a solution of what to the patient have been insoluble situations, his work in reeducation is rapidly attained.

There is a prime significance in the handling of the conflicts by persuasion, a mode, as we have seen, resting on the notions of transference. That a deep or considerable unconscious conflict is thus entirely mended is not believable; but that a restitution appears possible and, in the conversion hysteria, a disappearance of symptoms may lend a possible application to the neuroses of peace. It is apparent, however, that under these circumstances we possess no such precipitator of a conflict as war. Hence, it is not unlikely that the material presenting before us may possess no such possibilities of instant revision. It is less possible to reveal it "by a scratch." A second reflection on the article concerns itself with the apt manner in which the concepts of psychoanalysis have come to illuminate the neuroses of war and in their turn, perhaps, to be qualified and extended.

PARKER, New York.

Society Transactions

NEW YORK NEUROLOGICAL SOCIETY

Three Hundred and Sixty-ninth Regular Meeting, Jan. 7, 1919

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CASE OF AREFLEXIA, ASTERIOGNOSIS AND OTHER SENSORY DEFECTS OF ABIOTROPHIC ORIGIN. Presented by DR. J. L. JOUGHIN.

The patient was a woman, aged 26, unmarried and by occupation a stenographer. The family history was negative. At the Post-Graduate Hospital in May, 1916, she complained of "lack of feeling" in her hands and inability to recognize objects held in them. This condition had existed as long as she could remember. At the age of 17 she had anemia, but no blood test was made. Menstruation had always been normal. She had always exhibited marked fumbling and clumsiness in handling objects and had no ability to recognize small objects and very little ability to recognize large objects by palpation. Slight, jerky movements of her hands, especially of her fingers had always been noticed, but there was no history of actual tremor or ataxia. Sense of position was impaired. For many years there had been excessive sweating of the entire body, especially of the extremities, which were always cold. There was no speech disturbance except a slight lisp which had existed for years. Summarizing and giving only the positive findings there were present: (1) complete areflexia, superficial and deep; (2) a definite, though slight loss of tactile sensibility to light pressure; (3) a more marked loss of muscle sensibility (postural sensibility); (4) a still more marked loss of vibratory sensibility; (5) an extreme enlargement of the circles of Weber. This loss of sense of tactile discrimination (Head) was the most marked sensory defect and the astereognosis was probably due mainly to this. (6) Astereognosis.

The areflexia could be explained by a degeneration (probably partial) of the posterior columns, thus breaking the reflex arc, the mechanism being the same as in locomotor ataxia and Friedreich's disease.

Sensibility was affected principally in its deep modalities and these impulses in all probability passed up the posterior columns to the medulla and so up via the fillet. The only form of cutaneous sensibility markedly affected was that of tactile discrimination and according to Head these impulses are conducted upward in the posterior columns accompanying the fibers which mediate deep sensibility.

The partial loss of cutaneous sensibility to light pressure (ordinary so-called tactile sensibility) was a little difficult to explain. Many neurologists thought these impulses were conveyed by the posterior columns or by short association fibers in the antero-lateral columns, or by the spino-thalamic tract or by several of these tracts functioning together and substituting for one another. In conditions where the posterior columns were affected—as in locomotor ataxia—cutaneous sensibility to light pressure was often deficient. Consequently, in this patient, while the reason for this loss might be difficult to explain, there was no reason why one should reject the view that there was degeneration of the posterior tracts of developmental or abiotrophic origin.

NEUROLOGIC COMPLICATIONS OF INFLUENZA. Presented by Dr. I. Abrahamson.

The speaker said the epidemic disease called influenza was still an unknown quantity so far as its essential cause was concerned. But it gave rise to polymorphic syndromes involving the nervous system. These syndromes might appear early or late; they might complicate or even mask the pulmonary aspect of the disease; they might appear so wholly detached from all pulmonary signs that the unwary would miss their etiologic relationship with the epidemic disease. They could not readily be classified. Neuralgias occurred affecting in all degrees of intensity any sensory area of the body. From the fifth cranial nerve, unilaterally or bilaterally, in one or more divisions, to the second sacral nerve, any nerve might be affected; but the nerves of the face and legs were most commonly implicated. These neuralgias were really true neuritides. Indeed, not only did tenderness and pain indicate the neuritic nature of the affection, but all grades of herpes zoster might give visible proof of inflammation.

Motor palsies at all sites and of all degrees might occur; palsy of the arm and hand muscles, of the thigh, leg and foot muscles, unilateral and bilateral, isolated, and general, severe and mild, transient and persistent. One case of multiple neuritis had been observed in which a lasting bilateral facial palsy was present. Such palsies might arise not merely from inflammation of the peripheral nerves but also from implication of the motor nerve nuclei, especially of the pons and bulb. In only two cases (cervical region) had there been nuclear involvement of the cord. All degrees of meningeal implication might be indicated clinically. Typical cases of encephalitis also occurred.

Among such heterogeneous manifestations it was difficult to distinguish, far less to classify. One might logically assume that during an epidemic nerve affections occurring in unusual frequency were probably of the same origin as the epidemic. One, therefore, looked with suspicion on the "lethargic encephalitis," described by Netter, Claude, and Sainton, a clinical picture suddenly revealed in these epidemic days and identified by these observers as a distinct disease entity. One might equally distinguish "acute ophthalmoplegia," "acute epidemic meningitis," or other acute syndromes. Until the contrary was proven all these bizarre and unusual appearances should be regarded as special manifestations or types of the prevailing so-called "Spanish influenza" and not as separate affections. Dr. Abrahamson had even now one case which, except for the absence of the cherry red spot in the macula, presented all the signs of amaurotic idiocy of acute origin; and another of thrombosis of the superior nasal branch of the central vein of the left eye, along with possible thrombosis of the brain sinuses.

Common to all these cases was their occurrence in epidemic areas. Examination showed that almost invariably there was complete absence of the usual signs in the cerebrospinal fluid, characterizing what was formerly regarded as influenzal (Pfeiffer bacillary influenza) implications of the central nervous system. On the contrary, in the prevailing epidemic, the cerebrospinal fluid was increased in amount, and the mononuclear cells were increased perhaps even as high as 100. The fluid so far as at present determined was sterile. In one case the fluid reduced Fehling's solution; in another there was no reduction. The amount and character of the fluid and the number of the cells varied somewhat according as the meninges or nerve cells of the nervous system bore the brunt of the attack.

DISCUSSION

Dr. M. Allen Starr expressed his interest in these cases of marked neurologic symptoms following influenza. They certainly showed that there was no part of the nervous system or its coverings which was exempt from attack by the agent responsible for the epidemic. He remembered very well twenty-five or thirty years ago at the time of the first great epidemic of influenza in this country that a number of articles were written on the nervous complications. He recalled particularly that Dr. James J. Putnam came from Boston to read before the Neurological Society a very interesting paper regarding neurological conditions developing subsequent to the grippe, and Dr. Starr distinctly recollected cases described as secondary meningitis and those corresponding to anterior poliomyelitis and superior encephalitis, multiple neuritis and single type neuritis. He therefore considered that there was reason to believe the cases reported by Dr. Abrahamson were postinfluenza cases, and that it was wise to have called attention to the frequency with which nervous complications followed the grippe.

Dr. William M. Leszynsky had seen a few cases of the kind mentioned and also a number of patients in whom mental symptoms developed after subsidence of active infection. In one case the patient had been getting along very well after influenza and pneumonia and the temperature had been normal for one week when it suddenly shot up and the patient became maniacal. She continued in this state for two or three days, the end of the third day, however, finding her sleeping well, taking food and rational. She was in such good condition that ultimate recovery was hoped for, but she died suddenly during the night. Another similar case had ended fatally. Dr. Leszynsky said he had seen a number of psychoneuroses following the grippe and it was a question whether these were a result of the disease alone or whether the influenza was only the exciting cause in a predisposed patient. At the Manhattan State Hospital they had recently admitted about fifty patients with a history of influenza preceding the psychosis, nearly all being of the manic depressive type. There was nothing distinctive in the symptomatology which would lead one to make the diagnosis of a postinfluenzal type without the previous history. From the viewpoint of the speaker, there was nothing in the character of the neurologic manifestations to make one consider them different from those seen in the epidemic of some years ago.

Major George H. Kirby, chief of the neuropsychiatric service, U. S. Army Hospital No. 1, said that his experience had been chiefly with soldiers presenting either psychotic or functional nervous symptoms subsequent to influenza, alone or complicated by pneumonia. The clinical pictures met had covered an extremely wide range and had furnished no positive evidence that influenza produced a special or characteristic form of mental disturbance. From the psychiatric standpoint the most common reaction to influenza was a postinfection, or postfebrile, state of neurotic fatigue, vasomotor instability, feeling of mental inadequacy, and depression. Probably these symptoms, in some degree at least, followed practically every case of influenza, but in a majority of cases they disappeared promptly, being regarded as hardly anything more than a manifestation of a general debility, although they were very often indeed out of all proportion to the brief duration of the influenza and were unaccompanied by any marked general physical reduction. In other cases the fatigue and inadequacy symptoms persisted over a long period. Major Kirby felt that very little was known about the clinical position of these

states relative to fatigue syndromes due to other causes or to the so-called psychoneurotic types of neurasthenia.

The deliria (infective-exhaustive psychoses) formed the second most common type of mental disturbance complicating influenza. Particularly frequent during the period when the sensorium was clouded or just after the patient emerged from the delirium, were stuporous and various catatonic-like manifestations which unfortunately were often mistaken for dementia precox. Among the constitutional psychoses, manic-depressive insanity, particularly the depressed phase, most frequently appeared during or soon after influenza. Dementia precox rarely developed in connection with influenza unless schizophrenic traits had been previously in evidence. A few cases of paresis had been observed in which it seemed probable that influenza was responsible for initiating the first psychotic manifestations of the disease. In this connection Dr. Abrahamson's observations on the spinal fluid were suggestive. Major Kirby stated that in none of his cases in which syphilis of the nervous system could be ruled out was there any increase of the cellular content of the spinal fluid. He did not doubt, however, that a nonsyphilitic meningeal reaction might occur as a complication in some cases of influenza. He hoped that reports on the pathologic findings of the central nervous system of cases such as Dr. Abrahamson had observed would soon be made available.

Dr. Walter Timme said that he had seen few meningitic forms of postinfluenzal infection, but he had seen cases of bilateral facial involvement which he believed to be rather rare. The number of cases of these postinfluenza conditions was noteworthy. In Plattsburg there were three men who had had influenza abroad and had recovered. After reaching camp they became similarly affected, first one side of the face becoming involved and then the other side within a week. Another case which seemed to be due to influenza was that of a girl of 9 or 10 years of age in whom the symptomatology was that of poliomyelitis except that instead of depressed reflexes there were exaggerated reflexes, due to cortical cell involvement; polioencephalitis of the Strümpell-Lichtheim type. The cell count was 60 or 70 and there were also mononuclears. It seemed to Dr. Timme that these postinfluenza cases were so widely divergent that they should be considered as complications of influenza rather than as specific syndromes.

Dr. H. Climenko had observed, probably synchronously with many others, that the epidemic had transferred potential neurologic and psychologic tendencies into dynamic conditions. For example, a man was said to be suffering from a psychosis following influenza, but Dr. Climenko found the case to be an outspoken one of general paresis. The wife, also suffering from influenza, admitted a number of miscarriages and said that her husband had been treated for syphilis. He had been attending actively to business before the attack of influenza and developed all the acute symptoms of general paresis within a few days. The speaker also had noted that the severity of the influenza was not always in proportion to the severity of the subsequent neurologic symptoms. One patient gave a history of having been sick only one day, but his pupils reacted only slightly to light and one could readily see the possibility of multiple lesions of the brain. Both fluid and blood were negative.

Dr. Frederick Tilney described two cases. One suddenly developed paralysis agitans, first manifested in the right hand, then extending to the right leg and now showing a typical Parkinson syndrome. The other patient — a mild paretic—had suffered from influenza for a week when the temperature came down; but that night he jumped out of a window. This was unmis-

takably a fulminating case under the stimulus of added infection. It was very evident that latent processes might be brought out by influenza.

Dr. Abrahamson, in closing, said that subsequent to the epidemic of 1889 the discovery of Pfeiffer's bacillus had occurred and since then these micro-organisms had been found in all true cases of influenza. To call these other cases influenzal without bacillary evidence was to deny the value of the finding of the bacillus. No mention had been made in this paper of mental or functional disturbances or involvement of the ductless glands, but there was no doubt that there had been a whole series of these conditions following influenza, particularly involvement of the vasomotor system. Dr. Abrahamson had refrained from labeling his cases influenzal because up to date he had not been able to prove they were such.

THE MECHANISM OF PAIN FROM THE PHYSIOLOGICAL STANDPOINT. Presented by Dr. Joseph Byrne.

Dr. Byrne outlined an entirely new theory based on clinico-pathologic studies embracing lesions of the nervous system at various levels from the periphery to the cerebral cortex. Pain had been aptly described by Sherrington as the psychic equivalent of the nociceptive reflex. The speaker regarded the afferent nociceptive arcs as the forerunners of the pain paths leading to the optic thalamus from which indeed these latter were to be considered as developed. All forms of sensibility might ultimately be reduced to two primary forms, namely, (1) affective, and (2) critical. Affective sensibility was that through which one became aware of pain, pleasure or change of state. Critical sensibility, on the other hand, implied comparison. The impulses mediating the fundamental gross affecitve element (pain or hurt) entered into consciousness mainly in the optic thalamus, whereas the impulses mediating the critical sensibility entered into consciousness mainly at a higher level, presumably in the cerebral cortex. The speaker rejected Head's division of sensibility in the peripheral system of nerves into epicritic, protopathic and deep, and offered his own classification as follows: (1) superficial critical sensibility; (2) superficial affective; (3) deep critical, and (4) deep affective. This classification was simpler than Head's or Sherrington's (extero-ceptive, proprioceptive, and enteroceptive) and more in accord with the needs of clinical neurology. Superficial critical sensibility was evoked by such stimuli as light touch, degrees of heat and cold ranging about the neutral point or skin temperature, and compass points simultaneously but lightly applied. Supercial affective sensibility was evoked by such stimuli as pinprick under moderate pressure, cold ranging from 22 to 0 C. and heat ranging from 40 to 55 C. Deep critical sensibility embraced pressure touch and its localization, posture and passive movement, size, shape, weight (passive), the compass points simultaneously applied with firm pressure, etc. Deep affective sensibility embraced pressure pain, and heat and cold in extreme degrees, for example, 0 C. to 55 C. in massive prolonged application. In brief, then, the theory of the mechanism of pain was as follows: In normal sensibility the critical system controlled the affective system of neurons in such a way that the anabolic and catabolic processes in the affective neurons were nicely adjusted to the needs of circumstance by supplying suitable threshold, etc. The materials requisite for the initiation and conduction of nerve impulses (kinetoplasm, etc.) were supplied in such a manner and to such an extent

as to meet in the best manner possible the requisite needs of normal sensibility. Lesions causing dissociation of sensibility, such as that found in lesions of the peripheral nerves, in the medulla spinalis, in the brain stem or in the thalamus, upset these nicely adjusted mechanisms by interfering with the control normally exerted by the critical system on the affective system. The immediate effect of such lesions was the appearance of pathologic tenderness and hyperalgesia. In all such lesions the affective neurons themselves were directly implicated anatomically or functionally. This interference acted as a stimulus inciting the remaining portions of the affective neurons and especially the neuron bodies in the dorsal root ganglia to hypermetabolism in the interests of restoration of functional and anatomic continuity. One of the by-results of such hypermetabolism was the spontaneous or readily elicited overflow of neural energy (nerve impulses) brainward. This was the cardinal feature of pathologic tenderness and spontaneous pains. These two principles underlay the theory of the mechanism of pathologic pain and tenderness—namely, (1) dissociation, functional or anatomic, of the critical from the affective system of neurons, and (2) hypermetabolism of the injured or liberated affective neurons. The pain and tenderness in themselves represented a regressive type of sensibility serving a purpose similar to that of such primitive protective mechanisms as the nociceptive reflex.

Dr. Frederick Tilney had thought a great deal about this theory of Dr. Byrne, but he felt that all were still in the realm of speculation in spite of the distance to which this theory had carried them. Over and above the findings of Head and his disciples, Dr. Byrne, in the first place, had brought forward a broader conception of the somatic sensibility as a whole in that he recognized very clearly that there were two distinct types of somatic sensory elements—the affective and the discriminative. Of course in their phylogenetic and biologic bearing they were very different in the purposes they served. The affective was presumably an extremely primitive type of sensibility. That had clearly led Head to his term of "protopathic." It was undoubtedly a part of a defense element, and the speaker agreed with Dr. Byrne in his limitation of it to the hurt element. It was in the defense sensibility that the muscles, joints and bones had their qualities of peripheral sensibility.

The second point was the recognition of the critical sensibility which prevailed in the various qualities of some esthetic features. That served a different purpose. That was not intended for a defense mechanism like the nociceptive reflex but served the purpose of a cognitive method of protection, maintained in a process or combination of processes in the cerebral cortex which one made use of in adapting various types of sensation to various skilled purposes. The recognition, then, of these two types of sensibility was a distinct advance. Ranson had proved that there were two sets of fibers, one of them of unmyelinated or scantily myelinated fibers and these probably mediated the pure affective elements.

Coming to the question of the thalamus, Dr. Tilney was not clear in his mind that one was not far over his head in the determination of this unusual relation of two axonal processes. He felt that the theory at this juncture, however, offered a stimulus and an interesting outlook, but it was far from conclusive. There was a tremendous amount of work to be done before one could come to a definite conclusion. He believed in the main, that all were greatly indebted to Dr. Byrne for going forward as far as he had with his idea. It stood as an illustration of what a long, long trail lay here, but it would stimulate others eventually to reach its end.

Dr. Walter Timme said that a few years ago he was interested in the cutaneous phases of sensory disturbance and, as these investigations in their final analysis depended on experimental methods of testing sensation, he turned his attention to methods of examining for sensation especially regarding the specificity of the power of nerves for carrying certain affective stimuli. In the first place, regarding the experimental modes of obtaining these reactions, he had yet to see a sensation of heat evoked clinically by any other means than pressure against the skin by a test tube containing hot water, or by other physical means. This brought two elements into the picture, pressure and heat. Heat was always accentuated if combined with pressure. The only true method was by radiation of heat without touching the skin and by this one would obtain a different response on the part of the patient. This might be done with a lens refracting the rays of the sun or of an arc light. If heat through this means was sharply and suddenly applied and then taken away the patient would not be able to distinguish between heat and a pinprick. Both produced pain. Specificity of conduction in this instance was therefore absent. Again, if one changed the focus of such a lens and allowed only the central portion to carry the heat to the surface, one would get a different effect from an experiment in which all the radiation was allowed to fall on the skin. One would get pain, and with an increased amount of heat in the second instance one might get no pain. Why was this? For the reason that there was no sudden change from one state to the other. If one put his arm in hot water he did not feel the heat throughout the arm; he felt the heat only at the surface of the water. The same with cold. The same with pressure as seen with mercury. Dr. Timme explained that he meant by this that one did not distinguish heat, or cold, or pressure, or touch, or pain as such, but only distinguished differences in these qualities; and it was the differences which produced in the end-organs in circumscribed areas these changes of sensation. No nerve or series of nerves could conduct a difference, and if one changed the degree of such a difference, reducing it from sudden to gradual, all pain would cease. Consequently, the same amount of pressure, or light, or heat, or cold might be applied to exactly the same end-organ as when pain was produced; and if done slowly no pain would be produced. This did not alter the value of Dr. Byrne's theory that at several levels from the posterior spinal ganglia upward to and beyond the thalamus these differences might be made the starting point of effective impulses, purposeful protective activity, probably through a marked difference of potential in the nerve current of adjacent ganglion cells.

Dr. Byrne, in closing, reminded Dr. Tilney that his conception of the relation of the critical and affective paths within the thalamus was so far based merely on physiologic studies, but he felt quite certain that such a relationship was fully justified by the facts. He had studied no less than ten cases of thalamic syndrome each showing that identical dissociation on which he had based his subdivision of the peripheral sensory nerves into four sets or systems, namely, *superficial critical, superficial affective, deep critical and deep affective.* Thanks to the labors of Dejerine, Egger, Roussy and their colleagues, as well as of Head and Holmes, the picture of a thalamic syndrome, more especially on the sensory side, was a very clean-cut entity. Dr. Byrne had had no opportunity to make postmortem observations on any of his thalamic cases. The nearest he came to such a consummation was at an operation performed on one of his patients by Dr. Alfred S. Taylor. In this case, which exhibited typical thalamic dissociation phenomena, a blood clot and a collection

of serum were found in the internal capsule about the level of the thalamus. Undoubtedly, the lesion had involved the thalamus in its ventrolateral aspect. Since Dejerine and Egger called attention to the thalamic syndrome early in the present century, only about twenty necropsies had been reported in the literature.

Regarding Dr. Timme's remarks on sensory tests, Dr. Byrne thought that most of these referred really to the critical elements of sensitivity rather than to the fundamental affective elements which include merely "hurt," "pleasure" or "change of state" without further qualification. The very essence of all stimulation of necessity implied a difference or alteration of conditions at the point stimulated. The statement that pinprick sensation was felt on the application of heat through a lens in one instance, and was absent when the position of the lens was altered, recalled observations made long ago in testing with pinprick, namely, that pain was felt at first, then there was a period in which pain was not felt though the stimulation was continued and later on pain of a distinctly different type appeared. It should be remembered that heat, and by this was meant temperatures above 45 C., was an adequate stimulus for pain. Indeed, recent work in the modern psychologic laboratories had corrected neurologists in this respect with good reason, for heat in the true sense of the word was not the equivalent of warmth. Heat was really a perceptual fusion complex derived from stimulation of pain points plus paradoxical stimulation of cold spots. This could often be demonstrated by testing the skin of the forehead at the junction of the hair, where, if a warm stimulus were applied, not only could warmth be detected but cold also surrounding or within the area of warmth. It was a fact that as tests were ordinarily made every kind of stimulus made appeal to several different types of receptor mechanisms. Thus, pinprick implied pressure as well as hurt, and it also implied an additional critical element, namely, sharpness which was perhaps more nearly related to pressure sensitivity than it was to pain. Both heat and cold also involved contact and pressure and for that reason in making tests patients should be drilled to reply in order to the three different elements, "touch, hurt, heat," etc., accordingly as each of these was perceived. Another point about these tests was that one's education so far as it was derived from sensory impressions was dependent not so much on refined forms of stimulus akin to those employed in psychologic and neurologic studies, as on grosser, more extensive forms incidental to the individual's daily contact with his environment. In some of the lesions of the central nervous system, as for instance in a case of syringomyelia studied by the speaker, the findings were such as to confute a good deal of what had been accepted by modern psychologists as orthodox regarding the four modalities, namely, pressure (touch), pain, heat and cold. The only differentiation between the various paths in the peripheral nerves which so far could be regarded as safely established, was that between the pathways mediating the fundamental affective elements (hurt, etc.) and the pathways mediating the critical or discriminative elements. These latter (the critical system) might or might not be capable of being further subdivided into separate systems served by separate end-organs for mediating separate modalities, but it was only the fundamental *affective system,* mediating the "hurt," etc., elements as such, which so far have been established as separate and distinct from all other afferent paths subserving sensation and which in combination represent the *critical system.*